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NEW ZEALAND JOURNAL OF Agriculture

DECEMBER
·1947·

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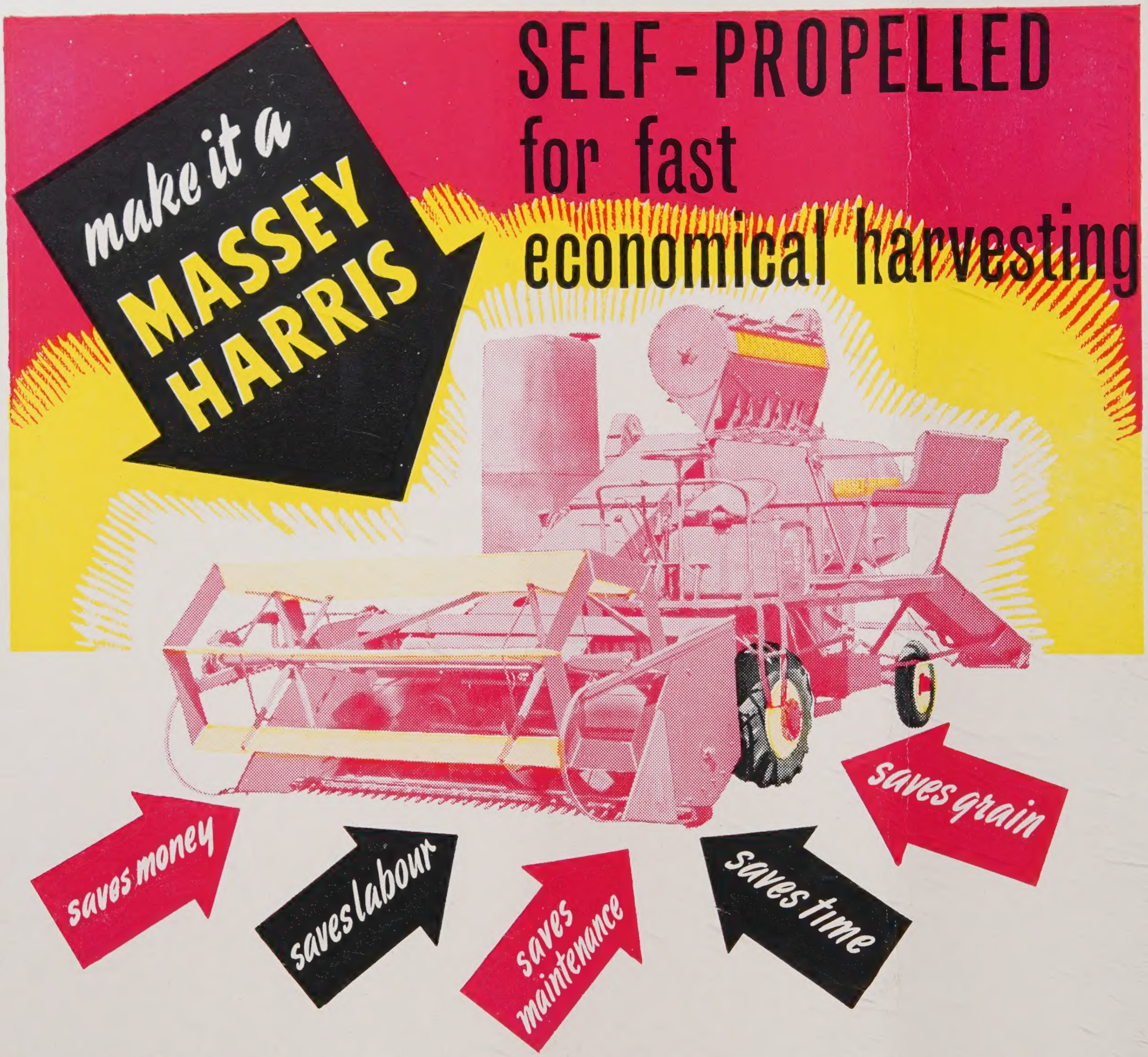

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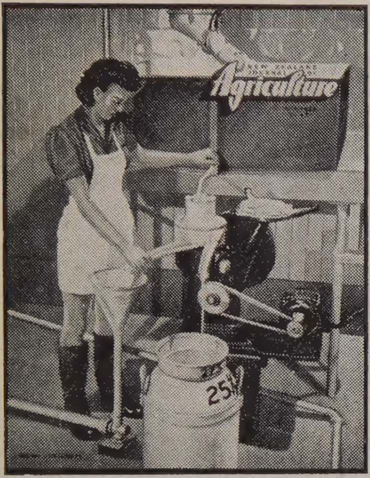
This month's cover



Buttermaking is the most important section of the dairy industry in New Zealand, the annual output of about 140,000 tons, of which a very large proportion is exported, yielding a return of nearly £30,000,000. The separation of the cream, which is the subject of this month's cover, painted from a photograph by the National Publicity Studios, is generally carried out on the farm. There are 47,783 separators in use on farms in the Dominion, and the skim-milk, a valuable pig food, is usually pumped direct from the farm dairy to the piggery.

•

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SUBSCRIPTION RATES

The *Journal* is issued monthly. The subscription within New Zealand is 2s. 6d. a year; the overseas subscription is 5s. The *Journal* may be ordered from any bookseller or newsagent, or direct from any office of the Department of Agriculture. Individual copies are available at 3d. a copy, post free.

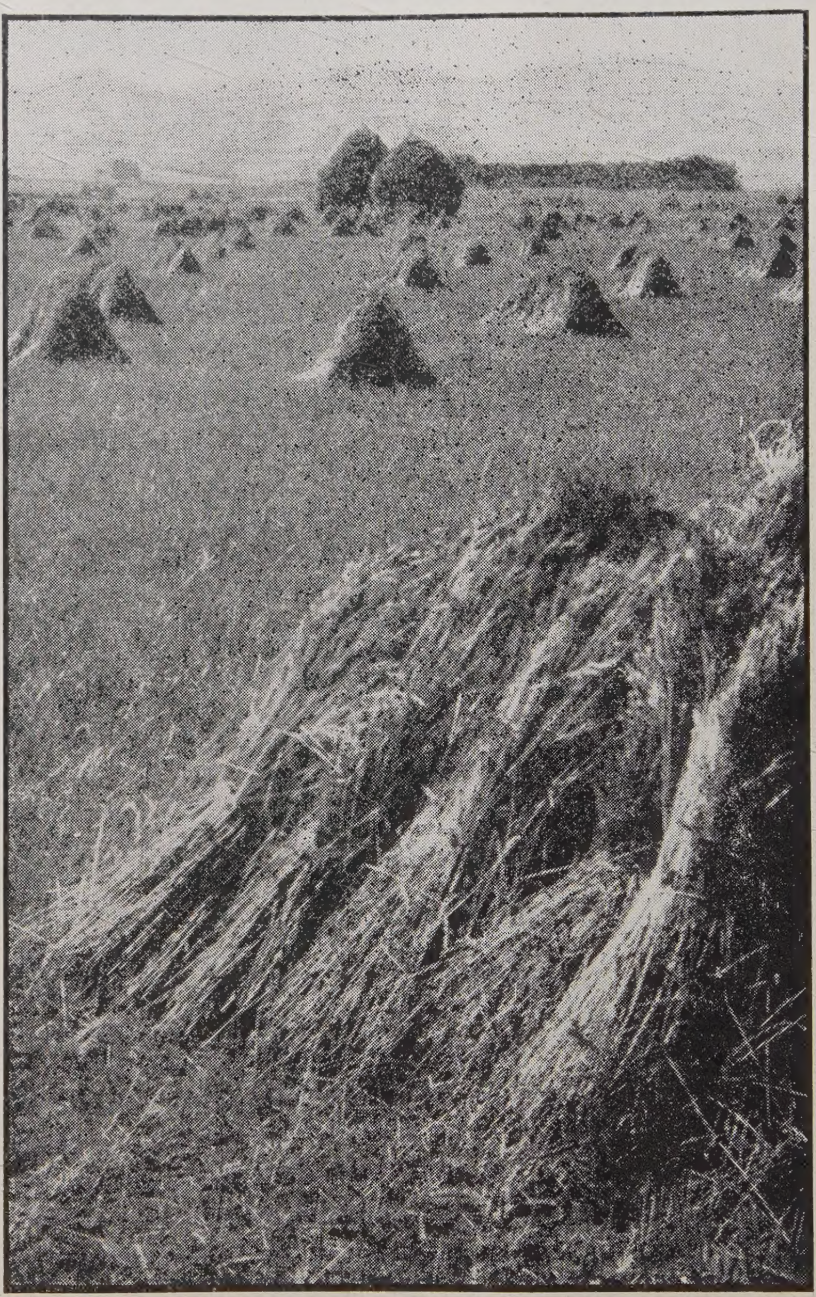
REGISTERED AT THE G.P.O., WELLINGTON, AS A MAGAZINE.

WHEAT is still urgently required

Farmers in the main wheat-growing areas should immediately give attention to:—

1. Planning next season's cropping programme to include the maximum area of wheat.

2. Take the necessary steps to see that efficient land preparation is commenced in plenty of time to ensure a good seed-bed.



[National Publicity Studios photo.

New Zealand's grain position is such that for some years to come it will be necessary to produce in this country as much wheat for flour and wheat offals for stock feed as possible.

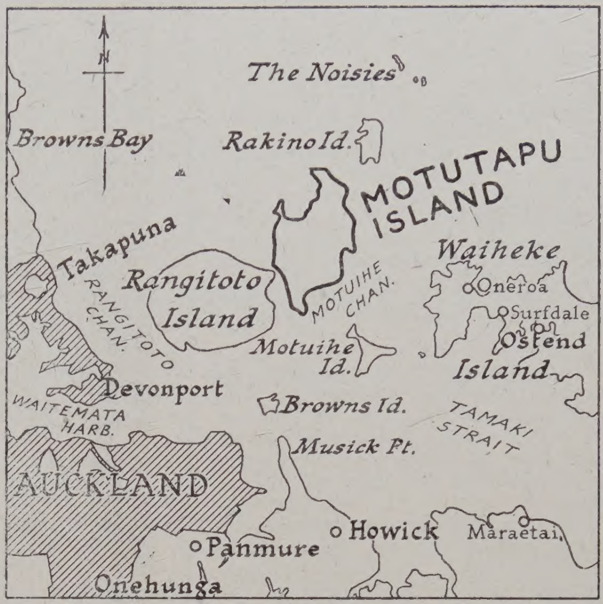
Quarantine Facilities for Imported Stock to be Provided at Auckland

THE acquisition by my Department of an area on Motutapu Island, in the Hauraki Gulf, for use as a quarantine ground for stock will remove one of the disabilities affecting the fullest possible resumption of the importations of bloodstock necessary for the welfare and progress of the Dominion's livestock industry. There has been a marked upward trend in importations of stock since the war, and the Government, in the establishment of this new station, is pleased to be able again to provide adequate quarantine facilities in the north, where Auckland is frequently a first port of call for ships carrying stock.

As a means of preventing the introduction into New Zealand of serious stock diseases, Regulations under the Stock Act require stock imported from certain countries to serve a period of quarantine on arrival in New Zealand. While undergoing this period of quarantine the animals are kept under regular surveillance by Veterinarians of my Department, and certain precautionary tests are applied to ensure that they are free from disease before being released to owners.

Before the war the Department maintained quarantine stations on Motuihe Island (Auckland) and Somes Island (Wellington), but with the outbreak of hostilities the station on Motuihe was acquired by the Navy as a training base. During the war importations of pedigree stock were on a limited scale, mainly because of the scarcity of shipping, and the quarantine facilities on Somes Island were able to cope with them. With the cessation of hostilities, however, importations showed an upward trend, which became more marked with the lifting of the embargo on the direct importation of stock from Great Britain. It became apparent that the provision of quarantine facilities at Auckland was an urgent necessity, particularly as many overseas vessels made Auckland a first port of call and stock would be accepted by certain shipping companies only on the condition that the animals were unloaded at Auckland.

As the quarantine station on Motuihe was being retained by the Navy as a permanent training base the Department of Agriculture was called on to find another site, but that proved difficult as, for effective quarantining, the site required to be not only isolated, preferably away from the mainland, but also convenient to Auckland, where the stock are unloaded. After protracted inquiries and negotiations my Department finally obtained an area on Motutapu Island, and that area is being declared a quarantine ground. Motutapu is immediately to the eastward of Rangitoto Island and is about nine miles from Auckland. The island is owned by the Crown and is under the control of the Army Department, but the major portion of it is being farmed by the Lands and Survey Department.



[*Drawn by Head Office, Lands and Survey Dept., Wellington.*

The quarantine station will be double ring fenced and adequate accommodation will be provided for the classes of stock required to undergo quarantine. After being unloaded at Auckland the stock will be conveyed to a wharf at Islington Bay, Rangitoto, and thence to the station by vehicular transport across a causeway linking the two islands. Suitable loading and unloading equipment will be provided.

The site contains several large prefabricated concrete magazines, one of which will be adapted for the housing of stock and another for the storage of hay, straw, fodder, and other stores. These magazines will be entirely suitable for the purposes. Sheep shelters, pig sties, and an adequate water supply are also necessary adjuncts to a properly-equipped quarantine station.

The work is now under way and efforts are being concentrated on the tasks of first importance so that stock can be taken into quarantine on Motutapu as early as possible, but I regret that the work is unlikely to be sufficiently far advanced for stock to be received until early next year. Therefore I wish to emphasise that importers should continue to arrange for the shipment of stock to Wellington and quarantining on Somes Island until they receive definite advice from the Department that stock can be taken into quarantine on Motutapu.

EDWARD CULLEN, Minister of Agriculture.

New Prices for Wheat, Oats, and Barley

NEW prices to growers for wheat in the 1947-48 and 1948-49 seasons and for oats, malting barley, and feed barley in the 1947-48 season have been announced.

Wheat

The maximum price for wheat has been increased from 7s. 4d. to 8s. per bushel for the 1947-48 and 1948-49 crops. A recent examination of farm costs revealed that certain increases have taken place since the price for this season's crop was fixed at 7s. 4d. In the circumstances the Government has decided to pay 8s. a bushel for this season's crop and to fix the same price for the following year.

If through unforeseen circumstances farmers prove costs justifying an increase beyond 8s., such an increase will be paid to the industry in respect of that crop. It is hoped that the early announcement of the price will induce farmers to sow an increased acreage of wheat, as it is imperative that the highest possible acreage be sown in wheat next year. This will not only be of advantage to the Dominion, but will assist materially other countries, particularly Britain, in their difficulties.

White Oats

The ceiling price of white oats per bushel in the 1947-48 season will be 4s. 8d. f.o.r.s.e. for the basic period up to May 31, 1948, compared with the maximum price of 4s. paid last season. In addition, monthly increments of 1d. per bushel, beginning on June 1, will be paid for white oats, reaching a maximum of 5s.

Evidence has shown that in contravention of the price order some growers have been selling their oats ex farm at the maximum f.o.r.s.e. price. To meet this situation it has been decided that the ex farm maximum price of white oats will be 2½d. less than f.o.r.s.e. price. It has also been decided that North Island growers will receive a differential of 1s. per bushel above South Island prices in the respective periods.

Malting Barley

For last season's harvest the basic bushel price of malting barley of all varieties was 5s. 6d. f.o.r.s.e. This price is to be increased to 6s. 3d. for certain specified varieties that have good malting and brewing qualities. These approved varieties are Spratt-Archer, Golden Archer, Plumage-Archer, Goldthorpe-Spratt, and Kinver Chevallier. The ceiling price of all other varieties is to be 6s. f.o.r.s.e.

The basic prices of 6s. for inferior varieties and 6s. 3d. for superior varieties will be subject to the same price differentials as have previously been given, according to the areas in which the barley is grown and to the method used in threshing.

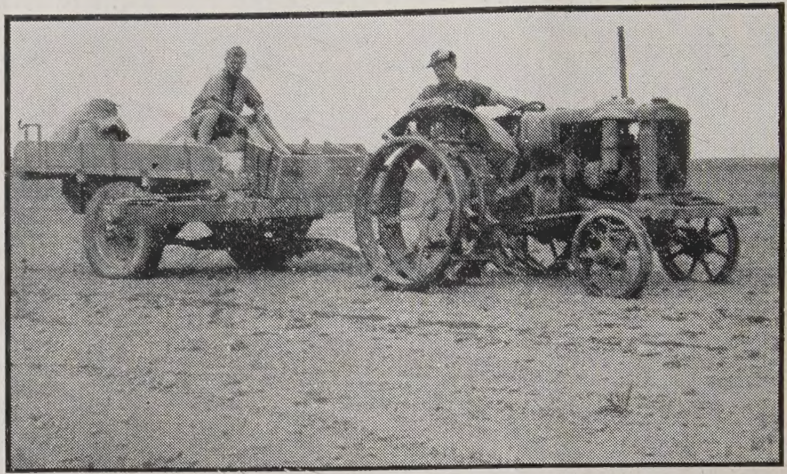
Feed Barley

The ceiling price per bushel for feed barley for the 1947-48 season will be 6s. f.o.r.s.e. In general, feed barley is lower in price than good malting barley, and under the new prices feed barley will be at the same price as lower-quality malting barley. It has been decided to allow a price differential of 1s. per bushel to North Island growers of feed barley.

BARLEY

In certain districts in New Zealand where the soil and climatic conditions are suitable for its production barley has become an important crop. Cultural and harvesting practices which have been developed in the production of barley are described in Bulletin No. 266, "Barley," which is obtainable free from any office of the Department of Agriculture.

Topdressing by Tractor and Trailer



The method of applying fertiliser by means of a distributor attached to the back of a truck has become increasingly popular with farmers on account of its speed and convenience. An adaptation of this method which has been found to be even more satisfactory is used by Mr. P. W. Hawkings on his farm at Kaipara Flats. In place of a truck Mr. Hawkings uses a strongly-constructed trailer which is pulled by a tractor and which serves to carry the fertiliser, but, as will be seen from the illustration, the distributor is fitted in front of the trailer, not behind it as is necessary when a truck is used. This arrangement has the obvious advantage that the operator can see ahead and can anticipate irregularities in the ground and is therefore much less liable to be caught unawares and thrown overboard through a sudden lurch of the machine.

Tractors continue to become increasingly popular on farms, and it has been proved by many farmers that the provision of a trailer adds considerably to the general utility of the tractor. Considering the importance of topdressing on most farms, it will be conceded that where a tractor is already available the system of topdressing used by Mr. Hawkings has much to recommend it.

Record Lambing Figures

THE Dominion lambing percentage for this season, 93.11, is the highest on record, according to estimates made by the Department of Agriculture. The percentage last year was 89.54.

The estimate for the North Island gives a lambing percentage of 92.47, compared with 87.92 last season. The estimated number of lambs born is 10,814,554, compared with 10,453,719 last season. The estimated lambing percentage for the South Island is 93.94, that for last season being 91.69. The number of lambs born is estimated to be 8,498,971, compared with 8,229,713 last season.

Comparisons of actual tailings against estimates of lambing in past seasons have shown that official estimates are consistently conservative. It is therefore hoped that Dominion tailings this season will reach 19,500,000.

A Survey of Rural Nelson and Marlborough

MOST New Zealanders have had some direct contact with the rural scene, by residence or by tours and holidays, but an appreciation of rural life and its importance to the country does not necessarily follow, and more than economic loss is involved in such lack of appreciation. Despite the machine and electronic age, a country still depends on the land, its rivers, deposits, and people, for food and clothing, homes and furniture, motor-cars and power. It is right, too, that city people should realise that country districts also have their community life. Small country towns may look unimpressive to a tourist, but their social and cultural activity is often of great vigour. And here a man can still be valued for his character rather than for the size of his bank balance or the extent of his worldly possessions. By a better understanding of the rural areas the restless striving of urban life can be placed in better perspective against the more enduring pattern of the countryside. It was partly to further such understanding that a survey of rural Nelson and Marlborough was undertaken by F. R. Bray, who at the time was Field Economist, Rural Development Division, Wellington. The second and concluding portions of this article reporting the results of the survey will be published in the January and February issues.

THIS survey is largely confined to rural areas—that is, it touches only lightly the activities of the towns of Blenheim and Westport and the cathedral city of Nelson, except as the organisation of these towns affects the economic and social life of surrounding country districts. Nor does it embrace all major aspects of country life; it does not specifically cover activities within the homes of country people or inquire into outlook and opinion. Concentrating on the more formal aspects of business and social life in country towns, it neglects except cursorily what goes on within farm and home.

But it is possible to learn much about the life of farming communities from a knowledge of land use, density of settlement, and township activities. The town is the centre of organised social life of the community and the place to which, in the main, residents of the dependent countryside look for religious, educational, administrative business, and recreational services. To qualify as a township within the scope of this survey the settlement must have the facilities to meet a wide range of these needs. That involves as a minimum a country store, at least one church or hall for services (usually both are present), a post office for communication and administration, and finally a school. Such a development involves as a minimum about 15 residences in the township; usually there is a hotel as well. Any settled area with less than these facilities is not assumed to have that organic unity which is the necessary prerequisite of a township.

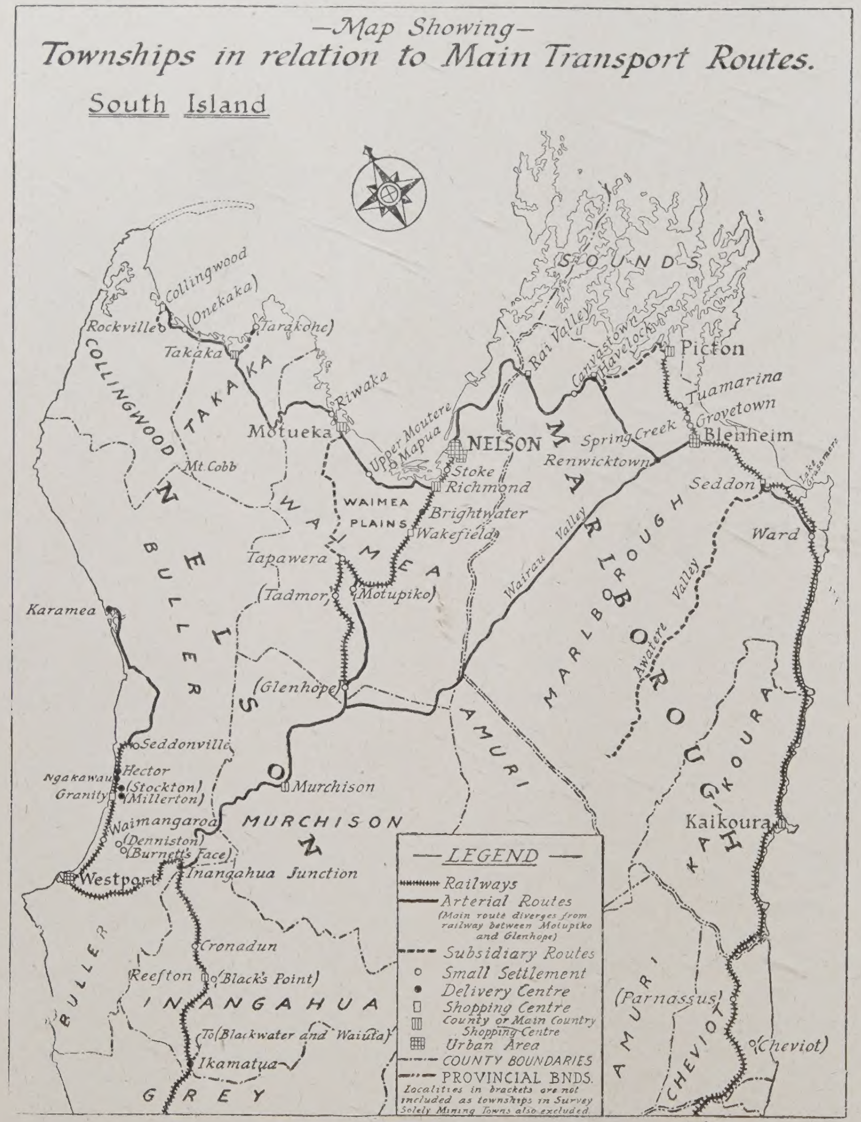
In retrospect the survey showed that land use and land policy are not things which can be determined once and for all on the basis of slopes and soil fertility maps or rainfall. Under the influence of economic variables, what are correct land use and land policy in the circumstances of one time are incorrect at other times. Thus land use must ever be changing in response to change in numbers and distribution of population, in tastes, standards of living, overseas prices, and transport. That applies to the aggregate area under different types of crops and the area of grazing for different types of livestock, the localities where and the intensity with which the activities are carried on, and the size of the individual farm unit.

Origins of Provinces

Nelson and Marlborough were settled by British immigrants early in New Zealand's history. The Waimea settlement, Nelson, was in the true traditions of the New Zealand Land Company, featuring selected immigrants, small town and country sections, and £1 an acre for land. But the extension of the company's settlement into Marlborough met with hostility from the Maoris in the Wairau Valley, and tragedy overtook the advance party of Captain Arthur Wakefield and surveyors on a spur overlooking what is now the peaceful little township of Tua Marina.

HEADING PHOTOGRAPH

Looking from the port of Nelson toward the plains of Motueka. The Takaka Valley is on the far side of the first range of hills. Photograph by W. C. Davies.


—Map Showing—
Townships in relation to Main Transport Routes.
South Island
SOUNDS
Collingwood
(Onekaka)
Rockville
(Tarakohe)
Takaka
TAKAKA
COLLINGWOOD
Riwaka
Motueka
Mt. Cobb
Upper Moutere
Mapua
NELSON
Stoke
Richmond
WAIMEA PLAINS
Brightwater
Wakefield
WAIMEA
Tapawera
(Tadmor)
(Motupiko)
Rai Valley
Canvastown
Havelock
Picton
Tuamarina
Grovetown
Spring Creek
Blenheim
Renwicktown
Seddon
Lake Grassmere
Ward
Wairau Valley
Awatere Valley
MARLBOROUGH
AWATERE
Karamea
BULLER
NELSON
(Glenhope)
AMURI
Seddonville
Ngakawau
Hector
(Stockton)
Granity
(Millerton)
Murchison
MURCHISON
Waimangaroa
(Denniston)
(Burnett's Face)
Westport
Inangahua Junction
Cronadun
Reefton
(Black's Point)
INANGAHUA
To (Blackwater and Waiuta)
Ikamatua
GREY
BULLER
Kaikoura
KAIKOURA
(Parnassus)
CHEVIOT
AMURI
(Cheviot)
LEGEND
Railways
Arterial Routes
(Main route diverges from railway between Motupiko and Glenhope)
Subsidiary Routes
○ Small Settlement
● Delivery Centre
▯ Shopping Centre
County or Main Country Shopping Centre
▦ Urban Area
COUNTY BOUNDARIES
PROVINCIAL BNDS.
Localities in brackets are not included as townships in Survey. Solely Mining Towns also excluded.

[Drawn by Head Office, Lands and Survey Dept., Wellington.

Direct arterial communication between Nelson and Westport, Nelson and Blenheim, Blenheim and Kaikoura, and Nelson-Motueka-Takaka is maintained by daily service cars and transport trucks. A Blenheim-Westport run via Tophouse is made several times weekly by service car, and feeder passenger and freight services also run several times weekly to Collingwood from Takaka and to Karamea from Westport. Local transport firms regularly serve the Wairau and Awatere Valleys. Railways connect Nelson with Glenhope, Greymouth with Westport via Reefton and Inangahua, and Westport with Seddonville. Picton, Blenheim, and Kaikoura are now on the main South Island railways system. Bus services provide transport between Wakefield and Nelson, between Picton and Blenheim, and from Westport to the nearby mining settlements. Small vessels and scows ply their ponderous way across Tasman and Golden Bays between the ports of Nelson, Mapua, Motueka, Tarakohe, Takaka, and Collingwood. Punts and launches are the main means of transport in the Sounds. Nelson, Picton, and Westport are the main shipping ports connecting with other parts of New Zealand, though Blenheim also has a small river port. Nelson, Blenheim, and Westport are on airway routes.

In the end, though a township such as Renwicktown, seven miles from Blenheim, can trace its origin to the same nucleus of ideas as inspired the Waimea settlement, development in Marlborough took a different course. The province was pioneered by the grazing of sheep and cattle on the tussock grasslands of large runholders.

The history of western Nelson was different again, for in that area mining, and in particular gold mining, rather than farming opened up the country. Gold was discovered in Collingwood in 1856, settlers from the Waimea having come into the district before that, and the goldfield was opened there in 1857. After the discovery of gold in Otago there was a further rush to western Nelson in 1864, this time to the west coast. Once gold had caused the opening up of these isolated and somewhat forbidding regions, it was succeeded by less spectacular but more permanent activities—timber milling, coal mining, and farming, at first pastoral and later dairying. The new activity often involved a change in the centre of population and only a few of the old gold-mining centres live on today. Lyell, Addison's Flat, and Charleston are typical of places which were at one time bustling towns with thousands of inhabitants. Others, like Reefton and Collingwood, have managed to survive, coal displacing gold for the benefit of Reefton.

In the small compass of the northern portion of the South Island can be found a greater diversity of farm production than anywhere else in New Zealand.

In Buller County on the narrow coastal strip farmers devote their attention to the fattening of cattle and dairying, supplemented by the usual pigs and bees. The extremely high rainfall in conjunction with a rather mild climate favours dairying.

Takaka, Collingwood, Murchison, and Inangahua are also counties with an annual rainfall of more than 50in. That, and the very mountainous nature of much of the country comprising these four counties, severely limit the extent of the occupied land, but dairying is prominent on the small areas of river flats.

The Sounds area consists mainly of broken hill country with poor access but an adequate, evenly-distributed rainfall.

Awatere County is extremely dry and subject to drought, with a rainfall of only 20 to 25in. a year. On the lower reaches of the Awatere Valley and on the rolling limestone foothills near Ward there is mixed farming—sheep, cropping, and small seed production, including lucerne for seed. This county rises into sub-montane grazing land with the majestic Tapuaenuku—in Cook's words "a mountain of stupendous height"

TABLE I: TYPES OF FARMING IN NELSON AND MARLBOROUGH

LIVESTOCK

County	Total occupied area (acres)	Total cattle	Dairy cows in milk	Pigs	Sheep shorn	Lambs tailed	*Sown grasses
Sounds	225,132	6,250	764	190	164,008	68,369	90,812
Marlborough	753,575	17,666	7,594	2,957	339,949	138,602	114,970
Awatere	899,807	11,789	695	122	309,736	148,929	128,423
Kaikoura	401,783	9,814	3,570	2,314	157,193	63,832	50,974
Waimea	576,732	23,484	9,558	4,787	253,438	108,675	127,318
Takaka	83,215	9,958	5,663	3,523	46,847	18,830	37,935
Collingwood	147,672	7,239	2,952	1,574	27,061	10,967	29,999
Buller	96,785	12,743	6,341	2,730	3,490	2,394	28,158
Murchison	173,068	9,670	3,446	1,786	45,382	23,345	58,080
Inangahua	86,086	6,715	1,967	806	17,356	11,542	24,054
TOTALS	3,443,855	115,328	42,550	20,789	1,364,460	595,485	690,723
DOMINION	42,978,309	4,439,258	1,647,920	573,362	29,799,229	18,421,936	17,744,469

* As distinct from tussock and other native grass, scrub, bush, etc.

CROPS (ACRES)

County	Wheat	Oats	Barley	Peas	Grasses, clover, and lucerne for seed	Other crops	Grasses, clover, and lucerne for hay and silage	Green fodder crops	Root crops	Linen flax	Total, including others
Sounds	—	16	—	—	—	1	67	27	71	—	182
Marlborough	6,699	4,108	2,878	4,853	1,919	418	5,641	2,789	1,550	533	31,388
Awatere	1,486	2,110	485	2,841	529	38	1,620	2,296	279	138	11,822
Kaikoura	149	774	71	61	90	—	1,402	463	1,468	—	4,478
Waimea	561	3,541	1,613	1,134	361	†3,042	5,723	1,150	4,160	—	21,285
Takaka	20	—	—	—	—	—	2,024	—	—	—	2,044
Collingwood	15	132	4	4	—	4	581	14	86	—	840
Buller	—	117	6	—	—	—	708	5	12	—	848
Murchison	—	268	6	4	2	1	1,535	71	627	—	2,514
Inangahua	9	169	20	—	—	—	930	53	304	—	1,485
TOTALS	8,939	11,235	5,083	8,897	2,901	3,504	20,231	6,868	8,557	671	76,886
DOMINION	239,183	228,887	36,310	44,690	141,612	28,440	573,632	237,067	426,094	9,755	1,965,670

† Includes 2582 of the 2586 acres of tobacco grown in the Dominion.

ORCHARDS, MARKET GARDENS, ETC. (ACRES)

County	Plantations	Orchards	Grape Vines	Hop Vines	Market Gardens	Nurseries
Sounds	616	16	—	—	—	1
Marlborough	1,436	518	—	4	166	13
Awatere	1,294	—	—	—	—	—
Kaikoura	123	15	—	—	6	—
Waimea	33,501	3,697	7	542	1,042	32
Takaka	55	—	—	—	—	—
Collingwood	73	12	—	—	—	—
Buller	369	24	—	—	9	—
Murchison	24	24	—	—	—	—
Inangahua	160	21	—	—	—	—
TOTALS	37,651	4,327	7	546	1,223	46
DOMINION	859,737	19,196	513	546	16,083	871

(9465ft.)—towering over all. In this high country and also to the south of Ward is pastoral farming with sheep and cattle grazing.

Kaikoura, more exposed to the south and with a rainfall in excess of 40in., is suited to dairying on that tongue of flat land abutting the impressive Kaikoura Ranges (8500ft.).

On the larger valleys of the Waimea and the Wairau a remarkably diversified type of husbandry is practised, featuring early vegetables and market gardening, orcharding, the growing of hops and tobacco (confined mostly to the Motueka district), cereal and pulse crops, grain and small seeds including vegetable and flower seeds, against a background of fat lamb farming and a little dairying. Abundant sunshine, absence of early and late frosts, light to moderate rainfall, warm, comparatively-dry summers, fertile soil, and, in favoured localities, almost complete absence of wind make these areas ideal for intensive cultivation.

The farming characteristics of the 10 counties are shown in Table I, taken from the Agricultural and Pastoral Statistics, 1944.

Dairying, pastoral, and arable farming (including horticultural crops and small seeds) are about equal in importance. Estimates based on A. and P. production totals and 1942 prices suggest that the gross returns were in the vicinity of £1,000,000, £1,300,000, and £1,000,000 respectively. On the basis of the 5500 holdings in the two provinces, that is an average return of £600 gross, compared with a Dominion average of £1000 for that year. Though evidence undoubtedly points to a good deal of conservatism in farm management, and also lack of capital, the number of part-time holdings, operated in many cases by semi-retired people, tends to disturb comparisons with other parts of the Dominion. Furthermore, assessed county land values an acre are below the Dominion average almost in the same proportion as gross receipts a holding, as shown in Table II. On the whole the districts surveyed are not up to the Dominion average, though the favoured plains of the Waimea and Wairau must be well above.

TABLE II: GOVERNMENT VALUATION

	Area occupied Acres	Gross unimproved values	Gross capital values
Dominion	43,000,000	£162,232,046	£334,788,776
Nelson and Marlborough	3,400,000	£7,200,000	£14,900,000

In relation to Dominion totals, the most important items of farm production are tobacco, hops, orchard fruits, peas, barley, and certain small seeds such as subterranean clover and lucerne. Practically the only farm produce not represented in the districts under survey are the citrus and sub-tropical fruits of Auckland Province. The wide variation in rainfall, caused by a succession of mountain ranges and valley floors set across the path of the prevailing westerly winds, is of the utmost importance in determining this variety.

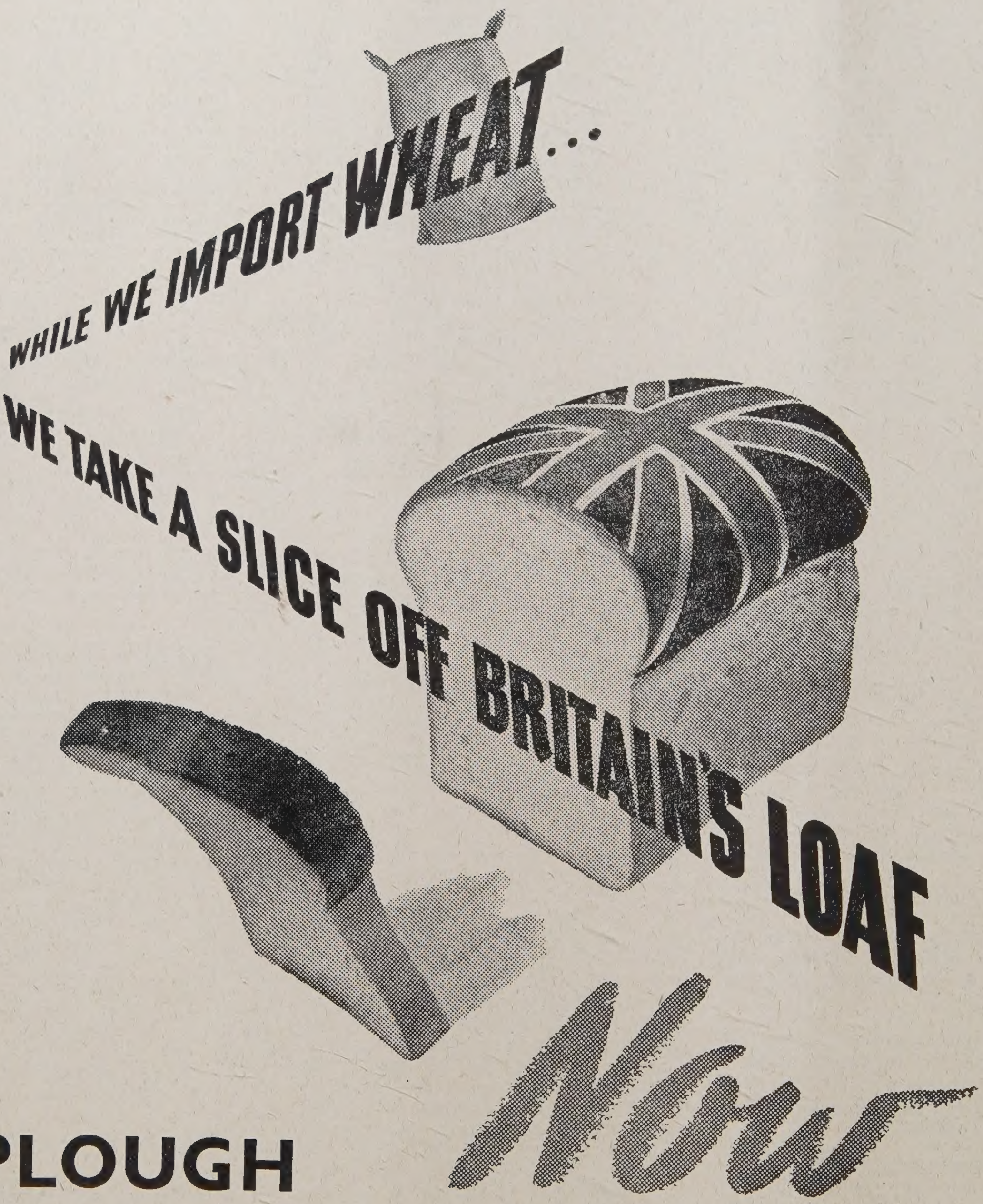
Size of Holdings

Table III shows the number and size of holdings in each county.

TABLE III: NUMBER AND SIZE OF HOLDINGS

County	Number of Holdings	Average Area Acres
Sounds	245	919
Marlborough	1,075	701
Awatere	239	3,765
Kaikoura	288	1,395
Waimea	2,033	284
Takaka	297	280
Collingwood	189	781
Buller	491	197
Murchison	223	776
Inangahua	273	315
TOTAL	5,353	
DOMINION	86,137	

Average area of holdings in Nelson and Marlborough: 643 acres.
Dominion average: 499 acres.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WE TAKE A SLICE OFF BRITAIN'S LOAF
Now

PLOUGH

FOR MORE

AUTUMN-SOWN WHEAT

W.I.24

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[*Neville R. Lewers photo.*

Lyell was once a thriving goldfield centre. Only a school, hotel, church, and a few other buildings remain from those other days.

Only two counties, Franklin and Waitemata, have a larger number of holdings than Waimea, and both those, primarily dairying and fat lamb counties, show the influence of proximity to Auckland in the numbers of market gardens and nurseries in Franklin and of orchards in Waitemata.

The hops, tobacco, orchard, and small fruits district of Riwaka is reputedly the most intensive farming district in New Zealand, with a typical holding of 8 to 10 acres, yet the overall average size of holdings in Waimea County is not even as low as that for Buller. The reason lies in the extent of second- and third-class hill country, some of which dries out very badly in dry summers and other of which is reverting to scrub kept in check by periodic firing. Similar remarks apply even more forcibly to Marlborough. In Buller, with dairying on the flats and the hill country too steep and too poor and the rainfall too high for occupation, the average size of holdings is low. Limitations to grazing of dry sheep and cattle are not so severe in Murchison and Collingwood Counties and consequently the average size of farm is larger.

At the other extreme is Awatere. Only three counties have larger average sizes of holdings: Lake County in the Otago Land District, and Amuri and Tawera in the Canterbury Land District. This extensive settlement has had peculiar effects on the nature of economic development.

Nelson and Marlborough are therefore to some extent New Zealand farming in miniature, but for that very reason are somewhat untypical, especially of the North Island, which has specialised farming districts without the variety shown in this survey.

Other Industries

Large-scale secondary industry producing consumer goods is almost completely absent in both provinces. Rural industries which are not purely extractive—quarrying, mining, and timber milling—are either those processing the raw materials, such as the Lime, Marble, and Chemical Company with works at Mapua, Waimea County, or processing primary produce, such as the Government Apple Dehydration Plant at Motueka.

Coal mining is largely confined to the west coast counties, Buller and Inangahua, where it is the basis of economic activity, largely carrying the overhead of transport and business services, which has allowed farming to develop. Small mines are also scattered through Murchison and Collingwood. Lime works extracting agricultural lime operate in both provinces, especially in Awatere, Waimea, Kaikoura, and Murchison. The chrystalline limestone of the Takaka Hill is highly desirable as building stone and the marble in Parliament Buildings came from those deposits. Pure calcium carbonate, occurring as white marble, also in the Takaka Hill, is used in making glass, paints, putty, insecticides, and pottery among other things. Production is 4000 tons a year, and it is pulverised by the Lime, Marble, and Chemical Works at Mapua. This company employs up to 30 men. There also feldspathic clay is ground for New Zealand Insulators, Temuka, Canterbury, for use in porcelain insulators and vitrified pottery. China clay or kaolin is similarly processed for use in fine pottery, paints, dentifrices, and vitreous enamelware.

Dunite, magnesite, talc, silica sand, quartzite, and asbestos also occur in certain areas of the Waimea-Takaka district and recently have been worked to a limited extent. Great quantities of serpentine which are said to be present could be used either with phosphatic fertiliser or as an industrial filler. In Collingwood County are workings of both dolomite (2500 tons annually), for use as a magnesium compound in phosphatic fertiliser and as a refractory lining for furnaces, and iron oxide for use in the purification of coal gas. In Awatere County a project for the recovery of salt from Lake Grassmere is under way.

Most important of all industries processing extracted raw materials is the Tarakohe Cement Works, employing, when visited, 100 men and supplying the South Island and a portion of the North Island with cement from local limestone, marl, and silica sand. This industry is capable of considerable expansion. Similarly important in terms of employment is the Cobb hydro-electric plant.

The outlook for all these enterprises seems favourable at the moment, and there is a heavy unsatisfied demand for cement in particular.

The prospects for the Onekaka iron and steel works do not appear so bright. Overhead expenses are heavy in an undertaking of this type and the machinery and furnace are costly to buy and to operate; an item such as lighting the blast furnace, which is small in comparison with the latest American blast furnaces, apparently costs about £2000. The local demand for the pig iron is not sufficient to keep the plant and staff operating at capacity the year round, nor are there the efficient rolling mills and finishing shops necessary to turn out a high-grade steel product and thus widen the uses for the iron. In the most modern plants many of these processes are integrated, with consequent economies in fuel, transport, and control of product. Those points emphasise that it is insufficient merely to possess mineral resources, or even to have the ability to produce a high-grade ore, if the prevailing economic factors are unfavourable.

Timber milling is scattered throughout Waimea, Collingwood, Inangahua, and Buller Counties. It has little close influence on the main townships of the districts because it has shifted away to remote areas, the more accessible timber stands having been cleared for farming or cut over many years ago. It is sometimes made a seasonal activity.

TABLE IV: EMPLOYMENT.

Showing by main industrial groups the numbers of units and persons employed as at October 15, 1946, in the Nelson, Blenheim, and Westport employment districts.* The schedule covers units employing two or more persons (including working proprietors) excluding seasonal industries, fishing and trapping, farming, and the loading and unloading of ships.

INDUSTRIAL GROUP	NELSON			BLENHEIM			WESTPORT			TOTAL		
	Units	Males	Females	Units	Males	Females	Units	Males	Females	Units	Males	Females
Food, drink, and tobacco	22	158	90	19	79	21	12	42	13	53	279	124
Textiles, clothing, and leather . .	10	39	66	15	38	141	5	9	33	30	86	240
Building materials and furnishings	45	339	12	20	100	—	6	17	1	71	456	13
Engineering and metal working . .	67	456	27	39	239	28	14	144	6	120	839	61
Miscellaneous manufacturing . .	14	100	36	9	50	20	3	12	5	26	162	61
Power and water	8	199	17	5	60	4	3	20	—	16	279	21
TOTAL: **Manufacturing Industries**	166	1,291	248	107	566	214	43	244	58	316	2,101	520
Building and construction . .	93	855	16	40	697	12	16	297	4	149	1,849	32
Primary Industries	29	344	4	6	52	—	30	975	2	65	1,371	6
Transport and Communications . .	50	628	112	32	557	53	25	379	37	107	1,564	202
Distribution and finance	217	982	513	136	554	262	65	190	117	418	1,726	892
Hotels and personal services . .	86	174	273	69	135	229	39	57	103	194	366	605
Administration and professional	66	673	570	41	357	270	24	261	137	131	1,291	977
GRAND TOTAL	707	4,947	1,736	431	2,918	1,040	242	2,403	458	1,380	10,268	3,234

*Excludes the southern half of Inangahua County, which is incorporated in the Greymouth employment district.

Gold mining is the one other activity that is at all widely distributed. There are two distinct types of mining, as well as the small alluvial workings. Dredging is done in the Mawheraiti Valley, Inangahua County, and quartz mining, whereby the gold is extracted by the complicated and costly cyanide process, is located at Waiuta in the same county. The Waiuta gold mine supports a population of 400 to 450, the company employing 120 men. Apart from the coal mining settlements of Denniston, Burnett's Face, Stockton, and Millerton, this is the sole instance in these provinces of non-farming activity completely determining the existence and site of a town, for Waiuta is high in the hills. As in those coal mining towns, the company provides practically all the employment for the residents; the only employment outside the mine is in tertiary industry, shops, and the postal service. Of the two types of gold mining, dredging is slightly more important to New Zealand; about 18 dredges are operating throughout the country, but there are only three quartz mines in New Zealand and only the Waihi mine is comparable with that at Waiuta. Whereas the gold dredges create fearful havoc in the upper soil—a cost to the community that is not being met—the depredations of the quartz mine are confined to the depths of the earth. Gold mining must still rank with coal mining as one of the basic activities of the west coast.

Fishing on a commercial scale is carried out at Picton, Havelock, and Kaikoura. Of those places Picton is the most important, with cool storage plant and a canning factory which processes not only fish and whale meat but also tomatoes, asparagus, and spaghetti to even out seasonal fluctuations in activity.

For the rest, apart from a firm at Motueka making fruit grading machines, the industry of the rural districts is confined to the processing of farm produce. The processing and canning of tomatoes, small fruits, and orchard fruits, the apple dehydration plant, and the tobacco grading stores call on substantial numbers of seasonal workers in Motueka. Freezing works at Stoke and Picton also make seasonal demands on local and imported labour, and dairy factories are located in all dairying districts—at Rockville (Collingwood), Takaka, Brightwater, Murchison, Karamea, Reefton, Rai Valley, Canvastown, Tua Marina, Koromiko and Linkwater (both near Picton), and Kaikoura. A brewery at Reefton and a malthouse at Picton complete the industrial picture of the rural areas.

Employment in Industry

In terms of employment, mining and the extraction of minerals are the most important rural industrial occupations, employing an estimated 1300 men in

Richmond, Nelson, extending through the middle distance, is in the form of two converging rectangles. The orchards of this district consist mostly of apple trees, as do those on the Moutere Hills in the left distance.

the two provinces. Sawmilling and fishing account for 450 in regular employment, and the processing of primary products for an additional 150. In addition about 100 men are engaged on the Cobb hydro-electric scheme.

Total Nelson-Marlborough employment other than directly in farming is revealed by National Employment Service returns for October, 1946, as 14,500, in the proportion of three men to every woman. Of that number more than half are engaged in tertiary industry—that is in wholesale and retail trade, transport and communication, finance, hotels and personal services, administration, and professional employment. The main centres, Nelson, Westport, and Blenheim, are primarily financial, commercial, distributive, administrative, and professional rather than manufacturing or processing centres. What secondary industry does exist is mainly confined to engineering, including automotive engineering and the production of building material and furniture. As shown in Table IV, the production units are small, a useful reminder of the continued vitality of the small business unit in some groups of industry. There is, however, a marked concentration in arterial transport.

One rather important instance of the processing of primary produce in an urban area is found in Nelson, where a large firm cans and processes tomatoes, orchard and small fruits, and peas. All those products are quite valuable in proportion to their bulk and do not lose weight in processing, so they can stand the costs of transport to the factory in the raw state, particularly as they come in a seasonal flush and are not staple items of consumption.

Importance of Farm and Factory

The added value of production in manufacturing pursuits in both rural and urban areas of the two provinces was about £1,200,000 in 1942-43 (1). It would appear that farming is between two and three times as important both in this respect and in permanent employment provided, whereas for the whole Dominion the two branches of industry are about equal in importance.

The two provinces are therefore primarily agricultural, pastoral, and mining, with dependent trades and services such as building and construction, which are two-thirds as important as manufacturing in terms of employment. Such factory industry as has developed has done so mainly because of the attraction of raw materials. In the rural areas there are only a few minor exceptions, including boat building at Picton, a brewery at Reefton, and local newspapers published twice weekly at Picton and Kaikoura. Such industries may be explained in terms of a strong local demand for their products, which have a local variation or are difficult to transport.

The preference by manufacturers and servicing works for the urban areas, and in particular for the four main centres, can be explained to some extent in the same terms that explain the presence of most industries in Nelson and Marlborough—the presence of the raw materials and proximity to the market. But there are probably some light industries—what have come to be known as "footloose" industries, in the textile trade for instance—where proximity to raw materials (tied or extractive industries) or to markets (residentiary industries) is not of decisive importance. It is therefore necessary to look for other factors, which may be found in the presence in the larger centres of quicker, cheaper, and more efficient transport; proximity to housing and labour supply, including skilled and professional workers; proximity to related trades and industries, providing, for example, repair or financial services, working capital, or fixed equipment; and better or cheaper water and power. The reticulation of electricty has created possibilities for decentralisation of industry absent in the era of coal, which is a costly product to transport.

Availability of Labour

Of those factors, one of great importance in explaining the preference of industry for the population centres is the availability of labour. In many industries—for example, assembly of motor vehicles, or even meat freezing and preserving—the large firm is preeminent. Such firms could not depend on suitable labour being available in the smaller country towns in the less-densely-settled areas, as there is a fairly clearly-defined limit to the time and money workers are prepared to spend on transport. It is axiomatic that it is easier to obtain the necessary labour and skills in a densely-settled, rapidly-growing area like the Hutt Valley than in a country area or a

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(1) Statistics of Factory Production, 1942-43, Census and Statistics Department, 1945. A factory is defined as an establishment engaged in the manufacture, repair, or preparation of articles for wholesale or retail trade or for export which employs at least two hands or uses motive power. Bakeries, butcheries, laundries, smithies, dressmaking, retailers, and bespoke tailors are excluded.

An aerial view of the Wairau Plains, Marlborough. Because of its low rainfall (25in. a year) and sunny climate the district is highly suited to the production of small seeds.

small township, just as it would be easier to start an orchestra, a golf club, or any other form of organised human activity. Some of the population in a farming district will be employed in farming, some possibly in sawmilling or mining, others in the shops, offices, and schools of the district, while still others will be dependants—housewives, children, and old people not available for regular wage-earning occupations. New industries must directly or indirectly absorb either those leaving school, who would otherwise leave the district, or seasonal workers in the off season. Otherwise, they must call on outside labour. That means the provision of housing accommodation, but it also means far more.

For the family man in the lower income groups the opportunity of living in a small country town with low rents and land available to grow vegetables and fruit and run a few fowls or even a cow is an attractive proposition if the climate is healthy and he and his family are not too isolated from health, educational, and some recreational services and from personal associations. But if any of these conditions is missing —and always a shift means breaking up friendships and associations—better occupational prospects are often required to induce a change in residence. For young people the inducements would have to be relatively greater, because not only are the advantages which the married man derives largely irrelevant, but the demand for entertainment and social contacts is, to use an economic term, inelastic. In other words, this demand is not easily overridden by possibilities of earning higher wages. Considering that the economic advantage usually lies the other way, the drift of young people from the farms and country districts is readily understandable, even if it is deplored.

On all counts a certain critical density of settlement and growth of tributary services in townships seems necessary before non-farming industry, other than extractive industry, can be permanently or successfully established. Otherwise the planned development of industry must meet the requirements set out—it must be so great and the advantages so weighty as to be able to provide the business, entertainment, and public services demanded by the people who will live there, or equivalent extra remuneration must be offered.

Of the area visited, only Picton (population 1500) and Motueka (2000) seem to have reached a size and development sufficient to justify hopes of small-scale, light, secondary, and servicing industries being woven into their economic fabric. The two counties which surround them, though they have the highest densities of settlement in the two provinces, are not densely settled even by New Zealand standards. Waimea has a density of less than 10 people a square mile; counties within the influence of industrialised areas in New Zealand have densities of 40 a square mile and upward. The reason for the relatively-low density in Waimea is the extent of barren or second- and third-class hill country, for density of settlement is very high in the country immediately surrounding Nelson and Motueka.

But apart from density of settlement other considerations apply to Picton and Motueka. Much of the transport and commercial development of Picton is carried by the tourist trade, and the town is also favourably situated on a fine harbour with good access to both Wellington and Blenheim (18 miles away) and through Blenheim to the rest of the South Island. Motueka, on the other hand, while also having a harbour of sorts, is the centre of a very intensive farming district with abundant seasonal labour to use. However, it must not be assumed that all seasonal workers, some of whom may go to Motueka for a change, to earn some cash, or for a working holiday, will want to settle there permanently.

The Waimea Plains, looking toward Tasman Bay, with Mapua Estuary showing beneath the low bluffs in the left distance. This view illustrates the intensive mixed grazing and cropping of the plains.

Restraining Flow of Population

The conclusions of this section may be briefly summarised: Highly-intensive farming in a district creates favourable conditions for industrial development, but the presence of a harbour, or natural resources in the form of coal or minerals, is sometimes sufficient in the absence of good farming land in the vicinity. It is not too much to say that all the major and minor industrial centres of New Zealand are either in intensive farming districts or possess harbours.

The most promising ways of reducing the flow of population from the country areas and smaller country towns appear to lie in attempts to increase the density of farming settlement—for example, by an extension of the area under dairying and cropping—or in conscious planning of industrial sites over a long period with the emphasis on trading estates. If a number of enterprises get together in the form of such estates, it is then possible to provide amenities for the employees and carry overheads in the way of transport and repair services which it would be impossible for one or two firms to do. Even so, it is still likely that industry would choose the larger country centres, towns like Timaru and Invercargill, or areas like Panmure or Upper Hutt close to the main centres.

Labour Organisation

It is interesting to see how the demands of local industry on the districts' available reserves of manpower are met. Two economic areas in particular depend on migration of labour to meet seasonal demands which cannot be supplied from within. There is a large annual movement of workers into the hops, tobacco, and orchard districts of Waimea and Motueka in particular. It is estimated that 3000 to 4000 jobs become available seasonally, the exact number depending on the season. An influx of some 1500 persons into the district is required to meet those demands. There is also a marked movement into Picton as a result of the seasonal peak in the activities of the local freezing works coinciding with that in the tourist trade. Some movement of shearers through the sheep districts of large holdings also occurs, but the reaction of dairy farmers to the work of haymaking is typical: This seasonal work is done by co-operation between farmers, with the assistance during the war of workers and schoolchildren from the neighbouring towns as unskilled labourers.

From the viewpoint of primary production—and farming provides the key to the utilisation of labour in the two provinces—the most pressing problems are the lack of labour available for farm maintenance work and the difficulty or impossibility of getting skilled workers to assist in hop and tobacco fields and in the orchards. Some hopes for a better supply of farm labour for scrub cutting, trimming shelter belts, clearing drains, and repairing fences lie in the development of contract work, but the possibilities of operating organised gangs of contract workers appear to be limited in farming districts which are not closely settled. In sparsely-settled districts these gangs would have to be itinerant and, with the inducements necessary to attract men to this type of life and the time and money that would be spent in travelling from farm to farm, the whole operation might prove rather costly.

There appear to be two other possibilities, though both relate rather to intensively-farmed districts, the one directed toward land policy and the other toward the development of rural industry. The development of rural industry, seasonal in nature, requires conditions which appear to be satisfied most completely in the Motueka district. Picton at present is rather a commercial and tourist centre. Only in Motueka is the extent of the demand for seasonal labour sufficiently important to make off-season local activities an encouraging proposition, and the nature of primary production in the district provides a workable base for absorbing labour into grading and processing industries. The establishment of several tobacco grading stores and an apple dehydration plant is a pointer to the direction in which development is proceeding.

But these developments have not provided a complete solution and it has not yet been found possible to retain in the district a sufficient number of skilled assistants to satisfy the requirements for seasonal labour on the very special type of holdings in the district. Other suggestions, mostly involving the use of public funds, have been put forward—afforestation, flood control, road work, and farm development. However, in any full employment economy seasonal labour is likely to prove a somewhat intractable problem, offering limited opportunities for advancement, even if there is little

[*Neville R. Lewers photo.*

Timber milling is an important west coast industry.

Tobacco growing requires extreme care from the pricking out of the plants into frames until the final curing of the leaf. Weather and curing hazards mean an anxious time for growers during the busy season from mid-September to April.

lost time in moving from one occupation to another.

Notwithstanding this problem, with the development of intensive farming and the wealth of minerals in the hinterland the economic outlook for Motueka seems bright.

In any land settlement policy involving the creation of small rural holdings the balance again swings in favour of the intensively-farmed, fertile lands of the Dominion. Though it is possible, depending on overseas markets, that some scope for closer settlement by the increase of area under dairying still exists, that is not what is primarily meant in this context, but rather the creation of part-time holdings with the occupants keeping bees, running poultry or a few cows, growing fruits, flowers, vegetables, and seeds, and supplementing their incomes by work for other farmers in the district. A large-scale policy of that nature would savour too much of peasant farming to be attractive, but as a means of providing a local reserve of labour and also of assisting a limited number of farm workers toward ownership of a full-time farm, it would appear to have some further possibilities, depending for success on the arrangement of work on the holding to fit in with seasonal demands of the district for labour.

An interesting position has arisen in Marlborough as a result of land settlement policies of the early days. In each of two rural areas land was subdivided into small workers' sections, but whereas in one case the fertility of the land finally enabled the selectors to make a living off their holdings, in the other the land was not sufficiently productive for highly-intensive farming and consequently a class dependent on outside labour came into existence. Attempt to assist the supply of seasonal farm labour means that the size of holding has to be related to the fertility of the land among other things.

Though it would probably be over-optimistic to expect the complete satisfaction of local demands for seasonal work from such measures, the amount of movement in and out of farming districts might be appreciably reduced and more skilled labour retained.

If many farmers at present also speak of a shortage of permanent labour, that is not sufficient reason to take hasty steps on a large scale in an attempt to increase the available supply of farm labour in view of the continuing mechanisation of farms, the present trend to sheep farming, and a tendency toward subdivision of holdings in the more intensively-farmed districts. How quickly the continued adoption of mechanisation is first going to catch up on labour shortages and then displace farm workers is impossible to foretell. By increasing the area of land which can be worked by one man it is likely ultimately to force a reduction in numbers not only of those working on farms but also of holdings. To avoid distress constructive measures will have to be taken to attract displaced persons into other employment.

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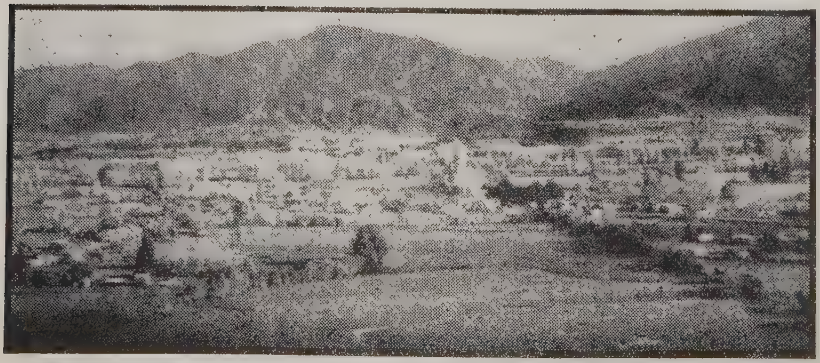
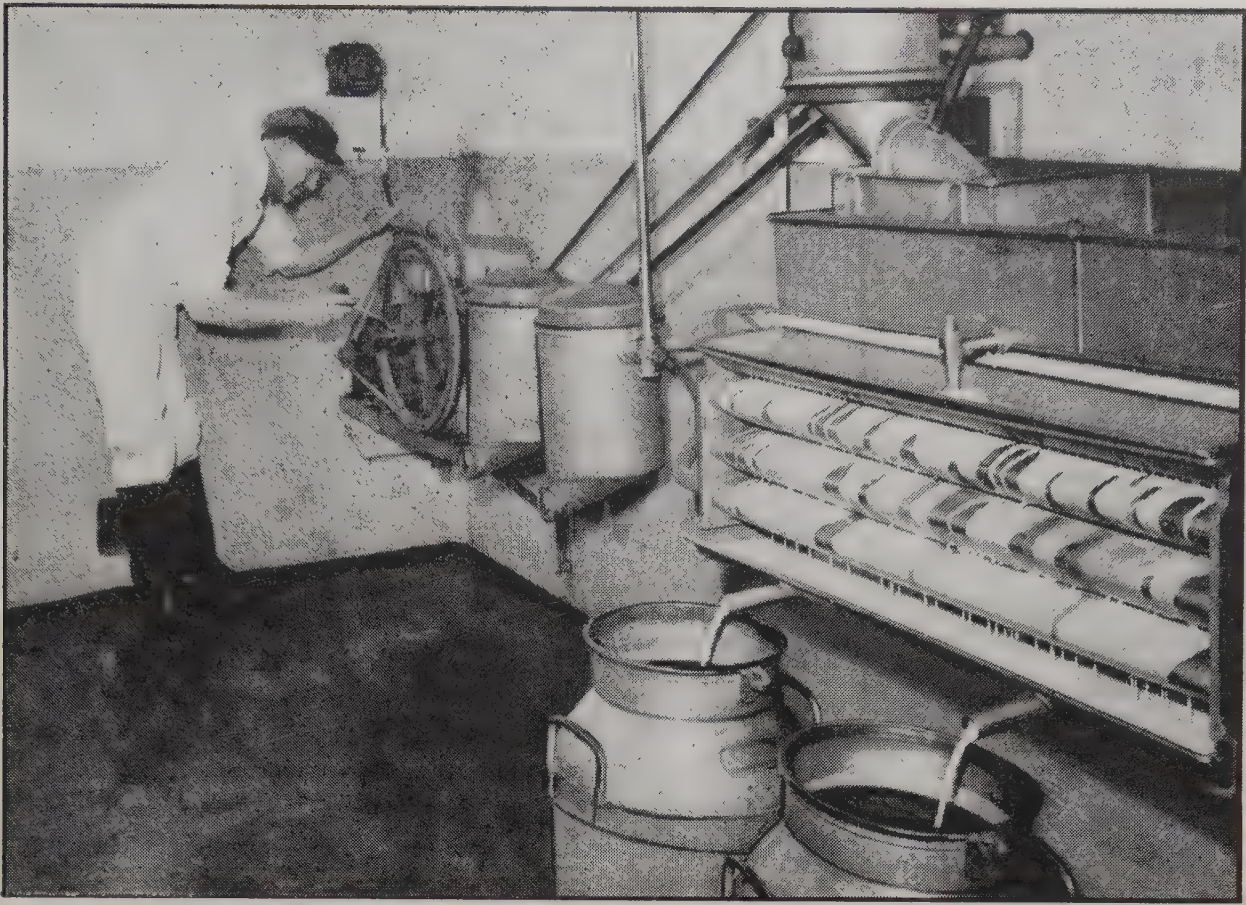


An aerial view of Takaka nestling in the V-shaped Takaka Valley, shut in by high hills and sea. Dairying is prominent on these flats. Because of the high rainfall grassland farming predominates and cropping is almost completely absent.



THE MARKET MILK INDUSTRY

THE market milk industry is an important section of dairy production which recent legislation has brought well to the fore in New Zealand. This article, the first of a series by T. P. J. Twomey, Superintendent of Market Milk Production, Dairy Division, gives an outline of the industry in New Zealand and other countries. Later articles will deal with methods of processing milk and the transportation and the distribution of it.

MARKET milk has a history which goes back into the mists of time, but like many other products of similar lineage, it has enjoyed serious industrial development only during the past 50 years. At first milk was consumed either direct from the animal or very soon afterward, and this arrangement was undoubtedly suited to the ways of life of our nomadic forefathers.

However, as nomadic encampments gave way to towns and later to cities enterprising milk producers no doubt saw their opportunity and became the world's first milkmen. Marketing was, by present standards, primitive, as open markets, or bazaars, were the shopping centres of those days. Because of the difficulty of making the milk keep it can be inferred that the lapse of time between production and consumption was short and that the animals were usually tethered close to the market stall. The animals—camels, sheep, goats, and cows—were grazed on such pasture as lay close to the cities, as apart from the expediency of having the areas of production and consumption near each other, the city walls were a necessary refuge in time of trouble.

Distribution was not usually practised, but there was even then the occasional enterprising salesman who felt he could increase his circle of patrons by bringing the milk to the customer instead of waiting for the customer to come to the milk. Such a man was the forerunner of the present milk roundsman, but he differed in many respects.

There was, however, one similarity. He delivered the milk to the customer's door in a sterile container, protected from dust, dirt, and direct sunshine, all in accordance with modern practice.

He achieved this desirable end by bringing the cow to the customer for milking on the doorstep—a method still adopted in certain parts of the world. In Malta, for instance, there are places where milk is still delivered direct from a goat led by the milkman.

However, distribution was generally a problem in towns and cities, and although local attempts must have been made from time to time, it was generally found easier to distribute the milk as a manufactured product like butter, ghee, or cheese. Cheese usually took pride of place, as it was the easiest dairy product to make under the existing circumstances.

As the centres of civilisation moved westward from Asia practices which were necessary in that climate became less so in the cooler latitudes of Western Europe, and during the later Middle Ages it can be assumed that milk became more an article of com-

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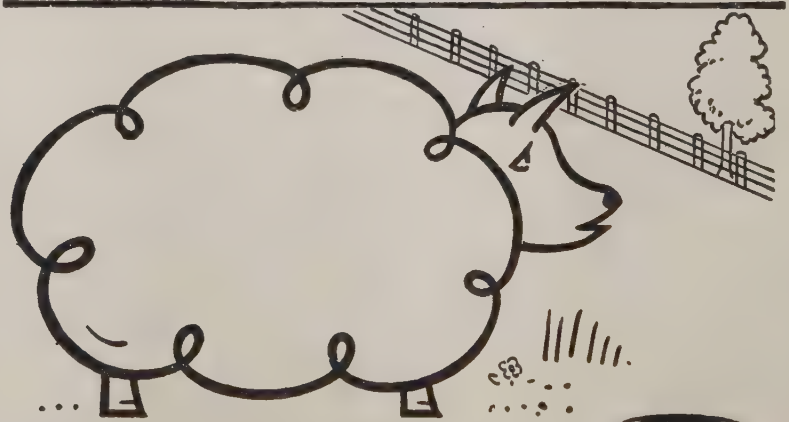

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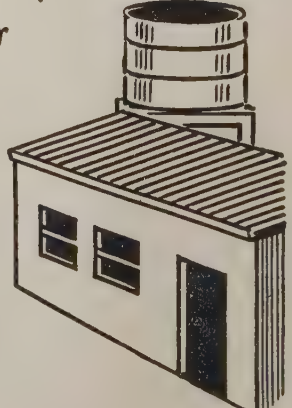

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merce as market milk and less as a manufactured product. The problem of production still continued and as times became more settled the tendency of urban populations to build outside as well as inside the city walls made the finding of adequate pasture sufficiently close to the city an almost insuperable difficulty. In London the problem was alleviated by stall-feeding the cows. During the last century this was the almost universal practice until modern methods of cooling and transporting milk by rail from long distances made it possible to bring milk into London from farms well out in the country.

Stall-feeding on the magnitude to which it was practised in London and other large cities may seem difficult to comprehend in this country, where even temporary stall-feeding is the exception and not the rule. Nevertheless it was in its day the only method by which London residents, especially those in the central areas remote from suburban farms, could be sure of a supply of milk. The cows were usually stall-fed for a full lactation and then sold off or turned out to grass in the country. Conditions were made as comfortable as possible for them, but the maintenance of cowsheds in the middle of densely-populated, heavily-built-up areas was bound to be a danger to public health, and in most modern municipalities by-laws have been passed to prohibit their construction or use.

During the many thousands of years market milk was an article of domestic commerce little real progress was made in developing a system whereby the cow could be located other than near the customer's doorstep.

Two things late in the nineteenth century effected a revolution. These were refrigeration and pasteurisation.

Refrigeration, which is the cooling of milk to a temperature below that in which bacteria only grow slowly, meant that milk could be bulked and chilled at country depots and shipped by rail over long distances without spoilage. Pasteurisation, which is only another name for heating the milk to a temperature well below boiling point to kill any bacteria which may be in the milk, meant that the milk could be made perfectly safe, even though it came in bulked lots from remote farms, before being delivered to the customers.

From these beginnings has grown the huge market milk industry of today. Modern milk plants have been built all over the world, and a visitor to one of them seeing the gleaming machines and the rows of sterile bottles, filled and ready for delivery, would find it hard to imagine that not long ago the customer received the milk from the cow on the doorstep.

Producer's Part

During this period of development the primary producer has not stood still. Indeed, if he had, the possibility of such development taking place would have been precluded.

In addition to cows the first producers turned to other animals, and this was understandable where the milk was consumed almost on the hoof. Goats, ewes, cows, and mares all contributed. Goat's milk is still widely used and forms a staple article of diet in several European countries. Ewe's milk is used in parts of Asia for the manufacture of cheese and is, of course, used in France for the manufacture of the world-famous Roquefort and Bondon cheeses. Mare's milk is used to a limited extent in parts of south-eastern Europe, where it is commonly fermented to make a slightly-alcoholic drink known as kefir. Eskimos drink reindeer's milk, and in certain districts Arabs favour camel's milk.

[*Green and Hahn Ltd. photo.*

Jersey.

Cow's milk, however, has attained the greatest popularity, and for this reason cows have been selected by progressive civilisations for breeding and developing for milk production. The contrast between a modern milk plant and a milk vendor's booth in ancient Babylon is no greater than the contrast between a cow of 4000 years ago and the high-yielding cow of today. The cow of centuries ago produced little more than was necessary to rear her calf, but the modern counterpart has been bred to give as high as 4000 gallons of milk in one lactation.

Composition of Milk

Cow's milk is made up of the following constituents: milk fat 4 per cent., milk sugar 5 per cent., protein 4 per cent., and water 87 per cent. Each in its own way serves to make milk the nearest approach to a balanced ration. The fat gives energy and growth, the milk sugar is used directly for energy, and the protein makes for body growth and cell replenishment. With these are also obtained two essential vitamins, A and D, the former functioning as a protective vitamin helping growth and maintaining the body's resistance to disease, and the latter as a means of preventing such diseases as rickets by enabling the body to utilise the calcium, or lime, which is also present in comparative abundance in milk.

The composition of milk is influenced by several factors, the most common being:—

1. Breed of the cow.
2. Stage of the lactation period.
3. Length of periods between milking.
4. Individuality or personality of the cow.
5. Health of the cow.

Of these factors, the most important from the commercial point of view are the first two, and the third is of importance when it is necessary to sell morning and evening milk separately.

When a dairyman thinks about quality in milk he usually thinks in terms of the amount of fat the milk contains. This is because of customers' habit of looking on the cream line as the final indicator of the richness of the milk (the cream line being the visible layer of cream on the top of a bottle of milk). Consequently, although there are legal standards laid down for the minimum amount of non-fatty substances the milk must contain, the dairyman and the producer tend to pay more attention to the fat content, and this practice results in some parts of the world in milk rich in fat fetching a higher price.

However, the constituent in milk which varies most in quantity is the fat, so the dairyman's more particular concern with this item is probably justified. The following table shows how the fat content of milk can vary when the factors given above are taken into consideration, and gives typical differences in fat content between different breeds of cows.

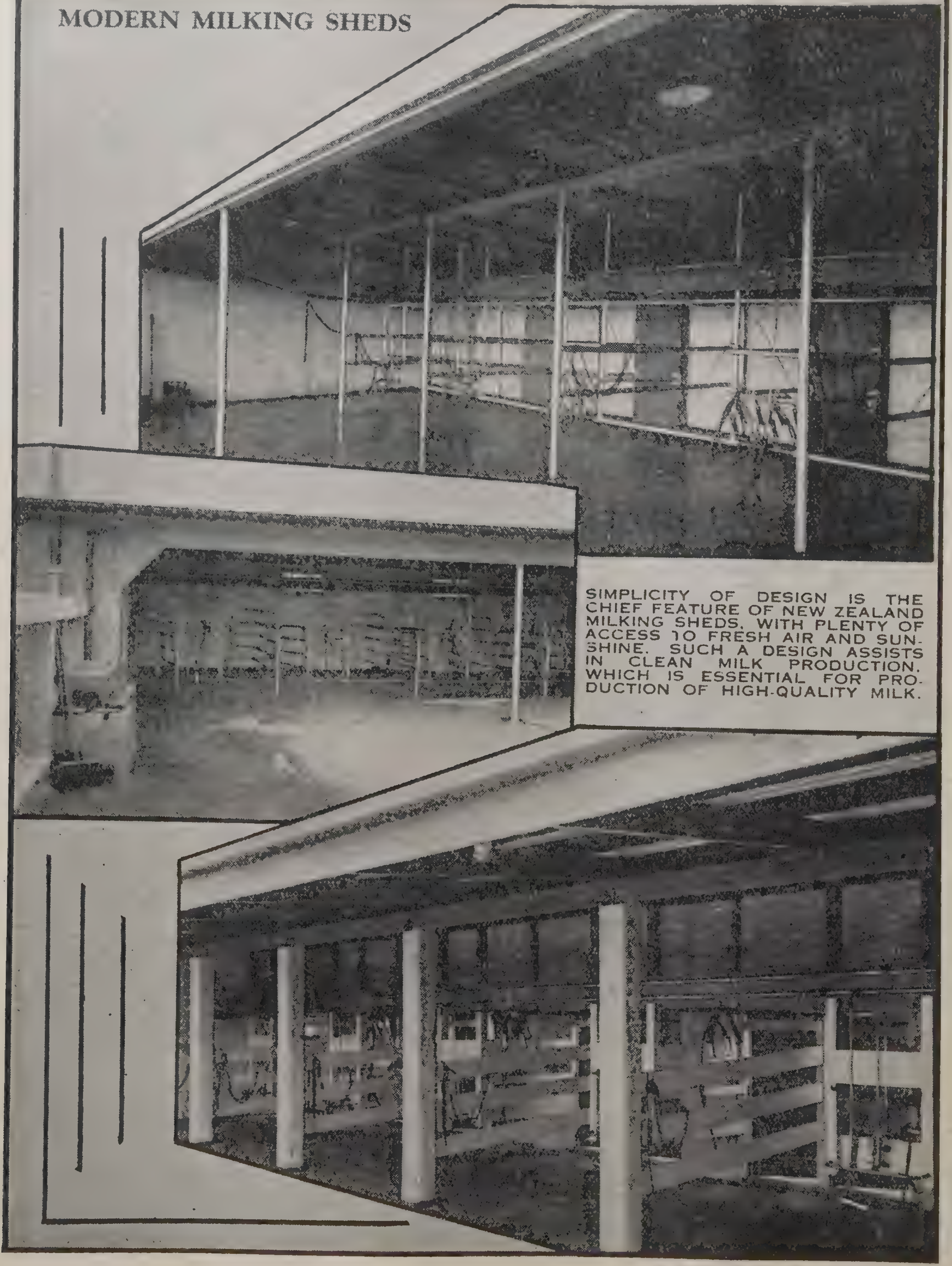
TYPICAL FAT CONTENT

Breed of cow	Per cent.
Jersey	5.5
Guernsey	5.0
Ayrshire	4.0
Milking Shorthorn	4.0
Friesian	3.5

Production of Market Milk

The quality of market milk cannot be improved after it leaves the farm. Neither refrigeration, pasteurisation, nor speedy delivery can make bad milk good. The responsibility lies definitely with the farmer to see that when he loads his milk cans on to the collection lorry the milk is as perfect as it can be. Nature has provided that the milk is completely hygienic when it leaves the cow, but after-milking contamination is man's

MODERN MILKING SHEDS



SIMPLICITY OF DESIGN IS THE CHIEF FEATURE OF NEW ZEALAND MILKING SHEDS, WITH PLENTY OF ACCESS TO FRESH AIR AND SUNSHINE. SUCH A DESIGN ASSISTS IN CLEAN MILK PRODUCTION, WHICH IS ESSENTIAL FOR PRODUCTION OF HIGH-QUALITY MILK.

responsibility. Dust, manure, flies, dirty milking machines, dirty coolers, and dirty cans are all means of spoiling Nature's work in producing a hygienic article.

As most of the market milk produced in New Zealand comes from machine-milked cows, it is not surprising that the greatest source of contamination can be a dirty milking machine. Cleaning a milking machine is not a difficult job, provided the following three golden rules are observed:—

Guernsey.

1. Flush with clean cold water.
2. Circulate with boiling water and caustic soda.
3. Scald with boiling water.

The cleaning of milking machines is covered in satisfactory detail in Bulletin No. 118, "Cleaning of Milking Machines," which is available free from any office of the Department of Agriculture.

Contamination with manure, dust, and dirt is fortunately not as common with machine milking as with hand milking, because to a large extent the milk follows a closed circuit and is not handled intermediately in a milking pail. However, contamination can creep in, as, for example, when teat cups are permitted to drop or lie on the floor. If hand milking is practised, narrow-neck milking pails should be used and every precaution taken to prevent dirt or dust dropping into the milk. It should be unnecessary to emphasise that cows should be cleaned before milking and hands should be kept well scrubbed.

Fly Menace

The fly nuisance is a menace to clean milk production, and unfortunately the danger is not sufficiently appreciated by some producers. Flies thrive on putrefying matter and are prolific carriers of germs, one fly usually carrying about 1,000,000 bacteria on its body. When it is remembered that in many countries the law stipulates milk shall not contain more than 100,000 bacteria per cubic centimetre it can be seen how potent a source of contamination flies can be.

The biggest danger from the fly menace lies in the type of germ the fly can spread. Typhoid fever is a typical example of fly-borne disease, and the thought of this makes the careful farmer watch the following points:—

1. The elimination or control of places where flies can breed, for example, manure heaps.
2. Careful attention to the design of earth closets if they are used.
3. Proper fly-screening of the milk-house.

Dirty cans and dirty utensils can undo the good achieved by attention to the points already mentioned. Modern milk depots are equipped with mechanical can-washing machines, and in England farmers are recommended not to wash the cans received back from these depots. In New Zealand, however, the practice is for the cans to be re-sterilised on the farms and this is not a difficult job, provided plenty of boiling water is used. After washing, cans and utensils are best sterilised in a sterilising chest. This is usually a galvanised-iron tank with a tight-fitting lid; steam is led into it either direct from a separate boiler or it is generated in the steriliser itself by an electric or similar heating arrangement. If a sterilising chest is not available, the next best method is to immerse the utensils in water as near as possible to boiling point for 10 to 15 minutes and then to place them on racks to drain and dry. If cans and utensils are left so that they do not drain, bacteria will tend to grow again, and, moreover, rust spots will start to appear.

[Green and Hahn Ltd. photo.
Ayrshire.

Excellent Carrier of Disease

No remarks on clean milk production would be complete without mention of a source of contamination which rarely gives rise to concern until an epidemic starts. This source is twofold—the health of the cow and the health of the cowman. Milk is unfortunately an excellent carrier of disease and not only can a cow suffering from some disease transmit it direct to the milk and thus to human beings, but a cowman suffering from certain diseases can also transmit them to the milk and so to people who may subsequently drink that milk. In some cases a cowman can even transmit a disease to the cow, who in turn can transmit it to the milk and thus pass it on to consumers, sometimes in epidemic form.

These milk-borne diseases can be very serious. To illustrate what can happen when farmers are careless about segregating the milk from diseased cows or about letting cowmen suffering from ill-health handle the cows, the more common milk-borne diseases can be grouped as follows:—

1. Infections carried from the cow through the milk to man—bovine tuberculosis and undulant fever.
2. Infections given to the milk by man and passed on by the milk to man—typhoid, paratyphoid, and scarlet fever.
3. Infections given to the cow's udder by man and re-transmitted by the milk to man—septic sore throat, scarlet fever, and diphtheria.

At present the solution of the problem of milk-borne diseases is pasteurisation or other form of heat treatment, but the preventive is to segregate diseased cows and maintain proper hygienic standards in the milk shed and in the dairy.

Farm Dairy Buildings

The buildings on a farm producing town milk differ in detail from country to country, but in the main they all follow a general pattern. The cows have to be housed (although this does not apply in New Zealand), they have to be milked, and the milk has to be strained, cooled, and filled into containers for dispatch. The three buildings in which these operations take place are known as the cowshed or barn, the milking shed, and the farm dairy. In most cases the first two designations apply to the same building, but the milk-house must always be separated from the milking shed. Furthermore, owing to the ease with which milk can absorb odours the relation of the milking shed to the prevailing winds and the location of such

Milking Shorthorn.

The photograph at the top of the opposite page is by Sparrow Industrial Pictures Ltd., and the lower by National Publicity Studios.

things as pig sties and manure heaps must also be carefully considered.

New Zealand operations generally necessitate only two buildings—the milking shed and the milk-house or milk-room. Both buildings are usually under the one roof but must be adequately separated. Where continuous outdoor grazing is practised, as in New Zealand, a cow barn is not necessary. This fact has decided the evolution of the type of milking shed most commonly found on well-managed farms in New Zealand. This milking shed is simple but efficient in design and permits almost continuous operation. This is achieved by releasing the cow from the front of the stall direct into a race (now usually covered) leading out to the paddocks. The succeeding cow follows on the tail of the preceding one, and congestion is avoided in the holding yard. This walk-through milking shed was developed during the First World War and, with the added refinements of the internal covered race and concrete walk-aways, has proved to be very suitable to New Zealand conditions.

Portable Bail

In England, where dairy cows are usually housed during the winter months, the practice is to erect a cow barn where cows are milked all the year round, live, and are fed in the winter. In northern England the cow barn is called a "shippon," and in Scotland a "cow-byre." In some parts of England the portable bail has attained popularity, this type of milking shed being taken to the cows in the field. The normal type consists of two sections. One houses the milking machine engine, a small boiler, a steaming chest for sterilising utensils, and in some cases a totally-enclosed milk cooler fed by a water tank and sometimes a mechanical refrigerator. The other section comprises covered accommodation and standings for the cows.

In conjunction with the portable bail it is usual to employ a portable pound, usually made of hurdles on wheels for assembling the cows for milking. The bail is usually moved every two days. The arrangement is labour saving; with a six-bail milker two people can handle 60 cows fairly easily.

American practice differs little from the British. In warmer parts single-storey cowsheds are in use, and in colder areas double-storey buildings are popular. In the latter the top storey is used for the storage of foodstuffs and where this is done it is compulsory for the floor of the top storey to be completely dust-tight so that no dust can gain access to and cause a nuisance in the cowshed below. The milk-house (or farm dairy as it is termed in New Zealand) is a separate room, and although some authorities have no objection to it adjoining the cowshed, other local ordinances demand that it be a completely separate building.

In Sweden, where the cows may have to be housed for the greater part of the year owing to a fairly rigorous climate, it is especially necessary for the cowsheds to be built with every consideration for comfort and hygiene. Here again the barn type is used with advantage, as the top storey not only provides adequate and convenient food storage space, but acts as an excellent insulating medium in bad weather.

A point of interest in Swedish practice is that for several years the Swedish Milk Publicity Society has encouraged the careful handling of milk in the cowshed and dairy by presenting diplomas of varying value for skill, hygiene, and ability. Individual rewards include bronze, silver, and gold medals.

[*Green and Hahn Ltd. photo.*

Friesian.

Though adequate and well-planned buildings are desirable and generally necessary, it cannot be too strongly emphasised that good buildings are in themselves no guarantee of good milk. Good buildings should be kept really clean if they are to serve this purpose properly. Walls and ceiling should be free of dust, dirt, and cobwebs; windows should be clean and properly fly-screened, and floors kept clean and in good repair.

Dairy Building Inspection

To assist the farmer in gaining and maintaining a high standard of clean milk production on the farm various advisory facilities are at his disposal in most dairying countries in the world. In New Zealand the Department of Agriculture has been given the responsibility of supervising production on the farm. This supervision is twofold, market milk farms coming under supervision of the Livestock Division and farms producing for cheese or butter under the Dairy Division. In both cases the knowledge and wide experience of each officer of the Department are at the disposal of producers, and to avoid unwise expenditure in the erection of milking sheds and farm dairies, regulations have been in effect for many years requiring proposed new buildings to conform to certain minimum standards before they can be put to use.

In England the supervision of production on the farm is mainly exercised by the Ministry of Health through the local municipal health authorities. In addition, the Ministry of Agriculture supervises the production of graded milk. A number of market milk plant operators maintain one or more farm inspectors on their staff, and in many cases this arrangement has proved to be of help both to the producer and purchaser.

Certified Milk

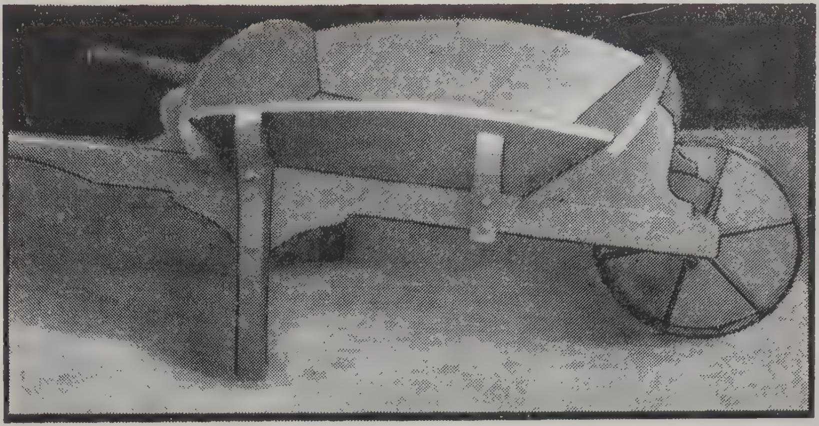
America adopts much the same procedure as England, except that the supervision of farms producing certified milk is undertaken by the American Association of Medical Milk Commissions. As the standards laid down for the production of certified milk are considerably higher than those required for the production of ordinary market milk, the association's supervision does not cut across the normal supervision exercised by local public health authorities. There is a desire in certain parts of the United States for the supervision of market milk-producing farms to come under federal control instead of under local health authority control. This appears to be a tendency toward a system similar to that at present in operation in New Zealand.

Though it is interesting to compare one system of supervision with others, the most important fact is that supervision should be exercised. No matter what supervising body is appointed by law, the officers of that body have only one duty—to help the milk producer to produce a first-class article. Progressive farmers welcome their advice; backward farmers tend to resent it. As the health of its people is a nation's greatest asset, it is obviously essential that such officers and the milk producers must work in the closest possible harmony. Both share a heavy responsibility.

Records in New Zealand, and more particularly in some other countries, prove beyond doubt that State interest in the hygienic conditions of milk production has been of substantial practical benefit. In New Zealand market milk has made strides in the right direction, but progress does not permit anyone to be unduly complacent. Though some countries have not done as good a job as the Dominion, other countries have advanced considerably further.

THE CONSTRUCTION OF A WHEELBARROW

By C. WALKER,
Assistant Fields Superintendent,
Palmerston North.



THE common wheelbarrow is a most valuable piece of equipment on farm, station, or town allotment, but to the amateur the construction of one is not an easy task. No two pieces of timber meet at right angles, and few cuts do not need adjustment with the plane for a perfect fit. However, the average handyman, exercising patience and care, should be able to make a good barrow from the directions provided in this article.

THE following materials are required:—

Timber

3in. x 2in. O.B. rimu: 2 lengths of 5ft.; 1 length of 15in.; 1 length of 20in.

9in. x 2in. matai: 1 length of 22in. (Two legs and two side brackets.)

12in. x 1in. white pine: 1 length of 12ft.

9in. x 1in. white pine: 2 lengths of 25½in.

If 12in. x 1in. timber cannot be obtained, narrower material may be used provided it is joined by dowels. All timber should be dressed, which will reduce dimensions by ⅛in.

Tie Rods

5/16in. or ⅜in. round iron: 1 length of 21in.; 1 length of 25in.

These should have all ends threaded and fitted with washers and nuts.

Bolts

Six bolts 3½in. x 5/16in., fitted with washers and nuts.

Wheel

One 16in. wheel and two gudgeons.

Screws

1½in., 12 gauge: 30 (10 for floor, 10 for body, 6 for front brackets, 4 for rear brackets).

2in., 12 gauge: 8 (2 for front brackets, 2 for rear brackets, 4 for leg brackets).

2in., 14 gauge: 4 for cross members.

1½in., 14 gauge: 4 for gudgeons.

Wherever screws are used holes should be bored through the piece of timber to be attached but not into that to which it is attached. All holes should be countersunk to take the screw heads.

Building the Chassis

Cut the two shafts to measurement and lay them on edge on a flat table or bench. To get them placed correctly mark a line down the centre of the flat surface and measure off and mark the distances at front and rear for the positions of the shafts. Place the front cross-member in position on the flat 13in. from the front, taking care to have it square with the centre line. Mark the shafts and the cross-member on each side.

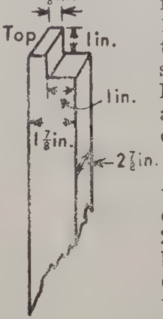


Fig. 3 — The tenon on a cross - member.

As the mortices in the shafts will be 1in. deep, allow an extra 2in. on the cross-member for two tenons. To cut the mortices mark the shafts ⅞in. from the top edges and make the mortices 2⅞in. x ⅞in. x 1in. deep. When these mortices have been completed bore ¼in. holes through the centre to the outside to take screws. By keeping the cross-member ⅞in. below the level of the shafts the flooring will fit flush with the tops of the shafts. Cut each end of the cross-member to provide a tenon according to Fig 3. When these are completed for both front and rear cross-members fit them into the shafts, bore a 3/16in. hole into each tenon, and use a 2in. 14 gauge screw to fix each end of the two cross - members securely to the shafts.

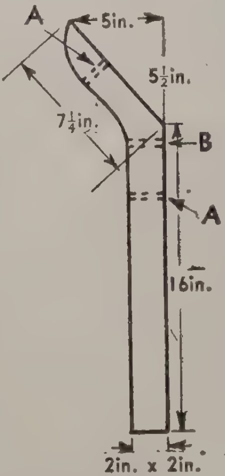


Fig. 4—A leg. A indicates bolt holes and B the hole for the rod.

Having the cross - members in position, holes can be bored to

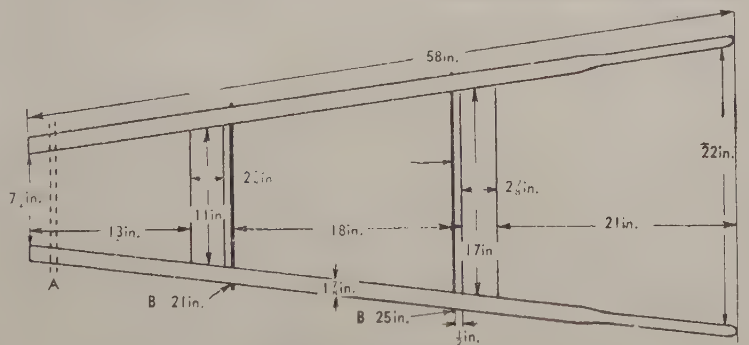


Fig. 1—The chassis.

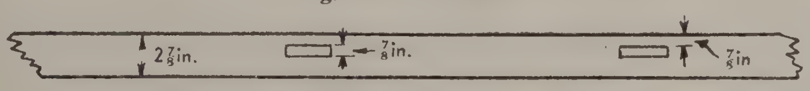
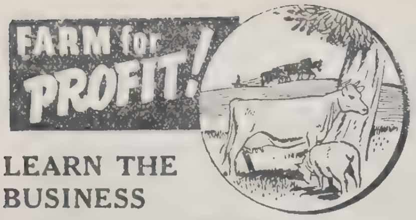


Fig. 2—Part of a shaft, showing the mortices.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take the tie rods. These holes should be ½in. behind the front cross-member and ½in. in front of the rear member. Insert the rear tie rod and while holding one leg in position tap the rod to mark the leg; that will indicate where the leg is to be bored. Mark the other leg similarly and repeat with the front tie rod for the side brackets. Then bore all four holes, fit the legs and side brackets on the rods, and tighten up, using washers in front of the nuts and taking care to square legs and brackets with the shafts.

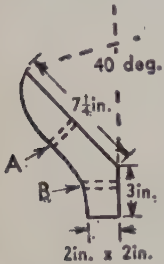


Fig. 5—A side bracket. A indicates the bolt hole and B the hole for the rod.

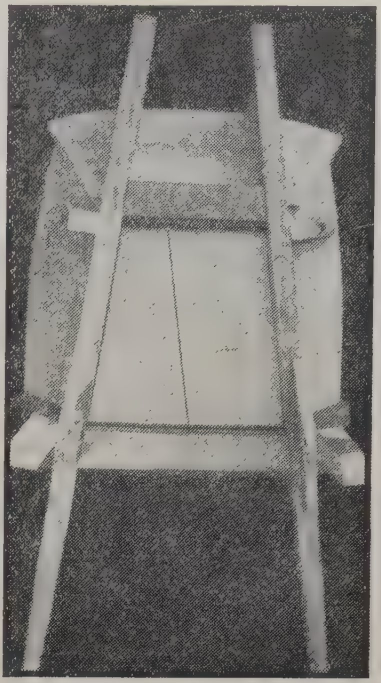
Fitting the Floor

Place one length of 9in. x 1in. timber inside and parallel to each shaft. Mark with a pencil the line along which they overlap, cut one along this line, and, holding the full piece in position, tap the other in to fit tightly. Mark both ends of the two pieces flush with the extreme edges of the cross-members, and saw them to give a flush fitting.

Fit the two pieces in position, bore six ¼in. holes at the rear and four at the front to go through the flooring only, countersink the holes, and screw the floor down securely with 1½in. 12 gauge screws.

Fitting the Body

Mark and cut out to dimensions the two sides, the front, and the back. Place each side in turn against the leg and side bracket, measure the amount of bevel required to make it fit neatly, and plane this off. The measurement will have to be made from the inside, but the bevelling is done to the outer edge. Usually ½ to ⅝in. will have to be planed off.



When both sides have been fitted take the front and hold it in position with the front edge flush with the front end of the floor. Again measure the amount of bevelling necessary to get a good fit, which, as before, will be ½ to ⅝in. Bolt the sides to the legs and side brackets, leaving sufficient room at the front for the front end to be fitted flush with the end of the floor on the outside.

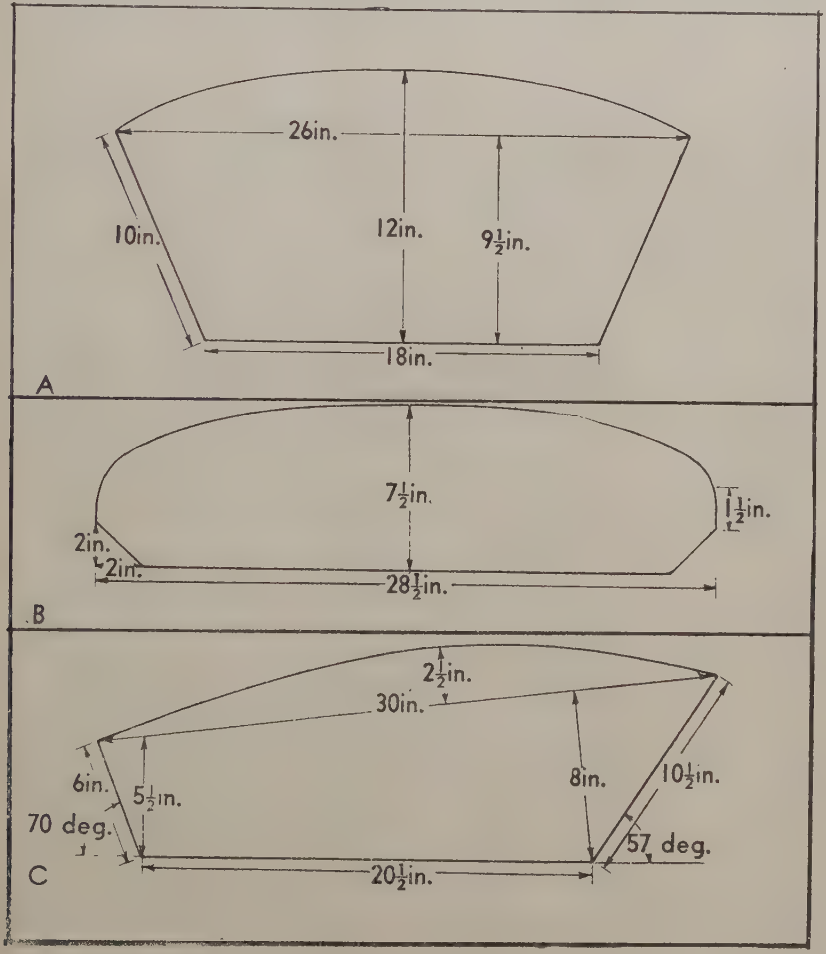


Fig. 6—A the front, B the back, C a side.

Mark the sides for bevel at both ends and plane them to the lines; that usually amounts to ½in. in front and 3/16in. at the rear. Fit the back and measure the bevel required at floor level—about ½in.—which should be planed off.

With all sides and ends fitted, place the front in a central position in relation to the sides and mark it with a pencil inside and out on both sides. Drill three ¼in. holes on each side in the front, countersink them, and screw the front to the sides with 1½in. 12 gauge screws, taking care that the screws are centred correctly.

Fit the back in a similar manner, using four 1½in. 12 gauge screws.

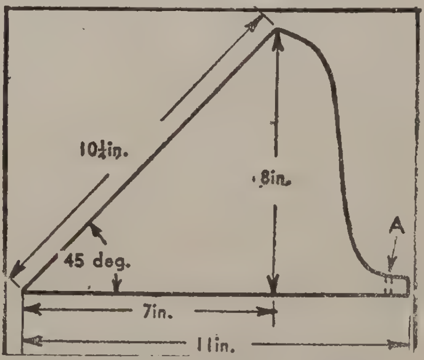
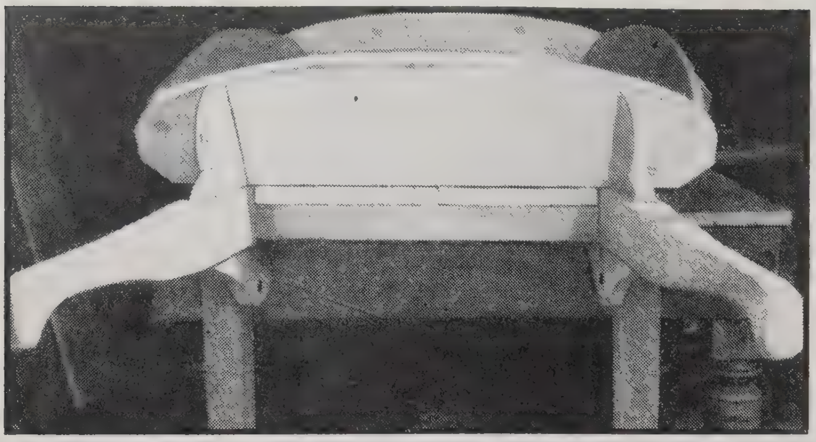


Fig. 7—A front bracket. A indicates the screw hole.

Fitting the Brackets

After cutting all brackets to the patterns in Figs. 5, 7, 8, and 9, begin fitting the front brackets.

CONSTRUCTION OF A WHEELBARROW



Mark a line ½in. inside the inner edge of the shaft and hold the bracket along this line and up to the front of the body to note the amount of bevel needed; this should be planed off. Fit the bracket in position and hold it there by a 2in. screw (inserted halfway) at the front end of the bracket. Mark a point ½in. in from the outside edge of the shaft just inside the front board, bring a rule up from this mark to the bracket, and mark a line inside the barrow for screws. Holes can then be bored through the front only and the bracket securely fixed with three 1½in. 12 gauge screws. Finally, screw the 2in. screw in front down tightly. Repeat this procedure for the other front bracket and the two rear brackets.

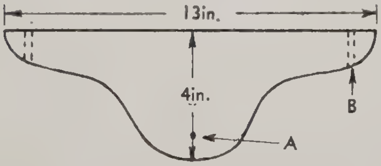


Fig. 8—A leg bracket. A indicates the bolt hole and B a screw hole.

Set a leg bracket in position by two countersunk 2in. screws, one at each end. Making certain the leg is square, bore a bolt hole through the leg and bracket and secure them with a 3½in. bolt. The other side is assembled in like manner.

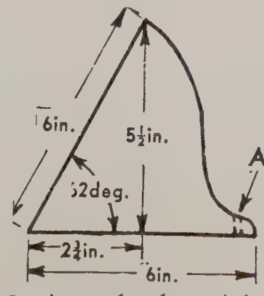


Fig. 9—A rear bracket. A indicates the screw hole.

Wheel and Handles

Place the gudgeons on the wheel and, with the barrow inverted, place the wheel between the shafts, making sure it is in the centre. Mark and bore the screw holes on the lower edges of the shafts and fasten the gudgeons in position with 1½in. 14 gauge screws. The line of the wheel axle will be about 2in. from the front of the shaft.

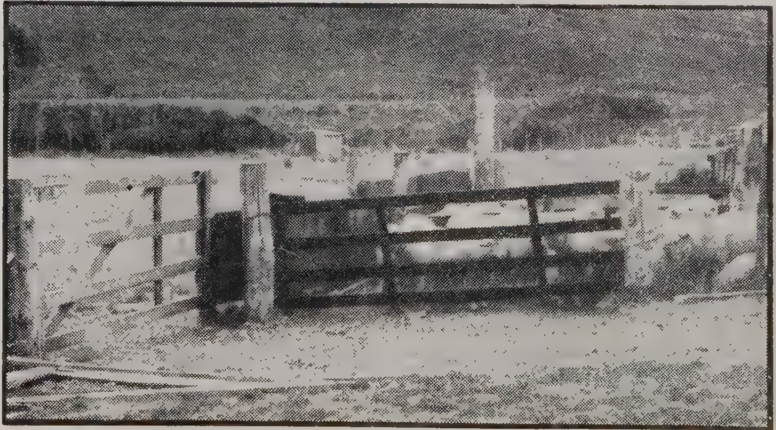
Plane down the ends of the shafts protruding from the rear end to a size that will make them suitable as handles. They may be either curved or plain.

Finally, all screw holes should be filled flush with putty, and the barrow finished off with a priming coat, followed by one or two coats of paint.

Points of interest in the construction of this barrow are the absence of nails and the use of soft wood for body construction. By using screws for assembly the replacement of any worn timbers is greatly simplified, and construction in white pine means that exposure will not lead to rapid deterioration by warping or splitting.

Thanks are expressed to Mr. C. H. Greening, Palmerston North, for supplying information for this article.

A SIMPLY-CONSTRUCTED DRAFTING PEN



If a history of New Zealand agriculture is ever written, the ingenuity of the farmer should receive honourable recognition. A catalogue of the home-made devices used on farms would read like a file from the patents office. Some devices are mechanically elaborate, but the great majority have the merit of extreme simplicity and obviously arose spontaneously from some bright idea. A good example of that class is the simple drafting pen illustrated, which was constructed by Mr. P. W. Hawkings on his farm at Kaipara Flats, Auckland.

The pen consists simply of a small enclosure with a narrow race leading to the latch post of a gate between two fields. The exit of the race can be blocked by a stop to hold the animals when required. In drafting, the stop board is removed and the main field gate is swung to and fro to guide the animals into either field as desired. The field on the left adjoins the main road, which is an advantage when drafting sheep to be sent off the farm.

For the dairy farmer running a few sheep this simple pen would be valuable for the drafting of fat lambs, culling, or any other of the manifold tasks associated with the management of a small flock. Its convenience will quickly repay the trifling cost of its erection.

—*P. S. SYME, Instructor in Agriculture, Warkworth.*

THE HOME GARDEN IN JANUARY

By A. G. KENNELLY, *Instructor in Vegetable Culture, Christchurch.*

IN most districts January provides the last opportunity for sowing peas, dwarf beans, carrots, and swedes to mature before winter. Spinach, silver beet, beetroot, turnip, radish, lettuce, "spring" onions, and parsley may be sown now or the sowing deferred until next month. Continuity of supply should be the aim of every home gardener, and failure to plant winter greens during December or January may result in a break in continuity of supply during winter or early spring. Where such crops as savoy cabbage, broccoli (winter cauliflower), curly kale, brussels sprouts, and leeks have not yet been set out the planting of a suitable selection to provide supplies from late autumn until the new season's crops have matured in late spring should be done without delay. In northern districts parsnips can still be sown and the spraying of tomatoes and potatoes should be attended to; the runners of kumaras should be kept lifted to prevent their rooting.

ASPARAGUS beds should be kept free from weeds and tomatoes pruned and tied to supports. Main crop potatoes should be earthed up and peas and beans kept picked to prevent premature decline in vigour of the vines due to seed maturing. Cabbage and other brassicas should be sprayed or dusted to destroy insect pests. Liquid manure can be applied with advantage to most crops; the hoe should be kept going and where necessary crops should be irrigated.

[Photo News Ltd. photo.

A row of Chantenay carrots sown toward the end of spring provides thinnings suitable for salads in midsummer and good roots for cooking by early autumn.

[Sparrow Industrial Pictures Ltd. photo.

Beans

Dwarf or French beans can now be sown for late autumn use. In most southern districts it is advisable to sow in the earlier part of January; the measure of success attained depends largely on favourable autumn weather. Grown under good conditions dwarf beans come into bearing in about 8 to 10 weeks. At this time of year they should be sown in a warm sheltered situation, for even relatively-light frosts will stop their development. Though the bean is not fastidious as to soil, it is important that a constant moisture supply should be maintained. A friable, well-drained loam reasonably supplied with organic matter suits the crop admirably. On poorly-drained soils the plants become yellow due to death of some of the roots and consequently much weakened, particularly if the weather is wet or if they are frequently irrigated. Flowers of beans grown where temperature changes are sudden or on soils that dry out rapidly frequently drop off or fail to set or the young pods become malformed—they may curl or hook or even wither and die. The soil should be well worked before sowing. Beans are not gross feeders and generally superphosphate is the only fertiliser necessary. It can be hoed in at the rate of 1lb. to seven yards of row immediately after growth has started. Watering after this should not be neglected. The bean is not a deep-rooting plant and seed is best sown in a trench about 2in. deep. January sowings in dry weather can be made a little deeper than sowings made early in the season. Sow 2 to 3in. deep in the trench, according to whether the soil is heavy or light, and 3in. apart in the rows, with the rows 2ft. to 2ft. 6in. apart.

Good dwarf varieties: The Prince, Tender Green, Burpees Stringless, Greenpod, and Woods Centenary (a golden-podded variety).

Diseases: The principal diseases of beans in New Zealand are anthracnose, bean mosaic, and bacterial wilt. Bacterial wilt is evident as small, greasy, water-soaked spots ⅛ to ½in. in diameter on leaves, stems, and pods. It causes dwarfing or death of young plants or because of unsightly lesions may make the pods unusable. It is seed borne and in moist conditions the bacterial ooze is rapidly spread by rain splashes or insects. **Anthracnose** is a fungus disease which forms dark-brown sunken lesions on pods and stems and a black discoloration of midribs and veins of the leaves. Anthracnose is also seed carried, and though in New

Zealand it does not normally cause as much damage as bacterial wilt, it occasionally renders a crop unfit for harvesting. **Bean mosaic** is quite distinct from the above and in severe infection is characterised by a dark mottling and distortion of the young leaves. Stunting of plants is common in susceptible lines and pods may be small, reduced in number, or fail to develop. Most crops have a small number of infected plants, but only rarely is the amount sufficient to bring about serious crop loss. This disease is also seed carried and can be transmitted from diseased to healthy plants by rubbing and by insects.

Methods of control available are (a) use of disease-free seed; (b) use of sprays and dusts; and (c) use of resistant varieties. In trials carried out by officers of the Plant Diseases Division of the Department of Scientific and Industrial Research use of resistant varieties was found to offer the most satisfactory solution to the problem, though it has the serious defect that a variety of special merit might not be reasonably resistant against one or all of the diseases. Burnley selection of Canadian Wonder and Dun proved highly resistant to bacterial wilt and mosaic, though the former was susceptible to anthracnose. Black Prince, Blue Pod, Woods Centenary, Dun, and Zulu King varieties were moderately resistant to the three diseases.

Beetroot

It is customary in most parts of New Zealand to make a final sowing of beetroot during January or February. In central and northern districts the later sowings usually produce good crops, but further south where the frosts of autumn are earlier and generally heavier it is usually advantageous to sow early. Beet is not particular as to soil and good crops can be grown in almost any well-worked and well-drained soil containing humus and not lacking in lime. A soil that was heavily manured for a previous crop is excellent, but if plant foods are thought to be lacking the addition of blood and bone mixed with twice its weight of superphosphate and broadcast at 3oz. a square yard with a good dressing of wood ashes well worked into the topsoil before sowing the seed will give satisfactory results. The seed should be sown ½in. deep in rows 12 to 14in. apart and the plants subsequently thinned to 4 to 5in. between the plants. Provided conditions are not too hot or dry, seedlings removed during thinning may be used for transplanting to another bed. They should be well watered after setting.

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Flat or turnip-rooted, intermediate, and long varieties are available. Good varieties of intermediate or turnip-rooted, which are usually chosen for late sowing, are Early Wonder, Egyptian Early, Darkest Globe, and Detroit Dark Red.

Carrots

In districts where the sowing of the main carrot crop has been delayed in an effort to avoid rust fly the sowing of the seed in mid-January should allow ample time for the development of well-grown roots before cold weather stops growth. Where rust fly is present the seed should be sown as far as practicable from any earlier sowing or from parsnips and celery, which are also liable to attack. In the South Island the carrot rust fly (*Psila rosae F.*) has not yet been officially recorded and any home gardener who suspects its presence there should advise his local field officer of the Department of Agriculture. The rust fly is a small, two-winged, shining black, yellow-legged fly about 1/6in. long. It lays its eggs in soil adjacent to developing carrot roots and the legless maggots enter the lower end of the carrot and work up. The maggots grow up to 1/3in. long and leave small, rusty-coloured tunnels through the roots. Young plants wilt and die. The rust fly is sometimes confused with the carrot aphis (*Cavariella aegopodii*) which commonly attacks carrot foliage in all parts of New Zealand. The aphis is easily controlled by spraying with nicotine sulphate 1:800 (1 fluid ounce of nicotine sulphate to four gallons of water and 2oz. of soap) applied preferably when conditions are hot and still. Complete coverage should be aimed at. Carrots sown in December or January often escape aphis attack, but in the south it is usually advisable to sow not later than early January, so that should the first sowing fail, there is still time to make another.

Carrots do well in a soil that was heavily manured for a previous crop; soils that are thought to be lacking in plant foods will benefit from the application of superphosphate at 2oz. a square yard broadcast after digging. Dry wood ashes can also with advantage be broadcast over the soil and raked in before sowing the seed. In dry weather the seed can be sown a little deeper, but the topsoil should not be permitted to dry out and form a crust through which the germinating seed will not be able to force its way. On some soils radish seed sown with the carrot seed is of value in breaking the crust. The quicker-germinating and more vigorous radish should be ready for harvesting from 3½ to 6 weeks according to variety. Except in heavy soils which consolidate and so prevent expansion carrots sown at the correct rate should rarely need thinning, but if desired they can be thinned to 3 to 4in. apart in the rows. If thinning is delayed the young roots may be used for soups, stews, etc. Where rust fly is present it is important that the soil be firmed around the roots after thinning.

Carrots can be protected from rust fly by broadcasting a repellant (horticultural naphthalene) at fortnightly intervals on the foliage and on about 6in. of each side of the row at the rate of 4oz. to 20ft. of row. Applications should not be made within 14 days of harvesting, as they may cause some residual flavour after cooking.

Carrot seed should be sown thinly ½in. deep in rows 12 to 15in. apart. Quarter of an ounce of seed will sow 100ft. of row. Good varieties are Chantenay, Early Krop, Manchester Table, and Market Garden.

Celery

December and January are the most favoured months for setting out celery. Most home gardeners purchase young celery plants from a seedsman or nurseryman, as the seedlings require consistently-higher temperatures for development to a size suitable for planting out than can be maintained in most parts of New Zealand without the aid of a glasshouse or heated frames. The seedlings should be thoroughly watered before setting out in prepared beds or trenches. Beds are usually planted in rows 4 to 6 wide with the plants set out in rows 10 to 12in. apart each way; in trenches a double row 9 to 12in. apart with the same spacing between the plants is satisfactory. The trench may be any desired depth up to 12in. Blanching of double rows can be done by drawing the soil high against the ribs, taking care not to allow any to get into the centre leaves of the plants, or by wrapping individual plants with stout paper. Beds containing multiple rows can best be blanched by placing a length of 12in. x 1in. timber along the outside edges of the bed. Blanching should not be commenced until the plants are within 2 or 3 weeks of maturity, as their development will otherwise be arrested.

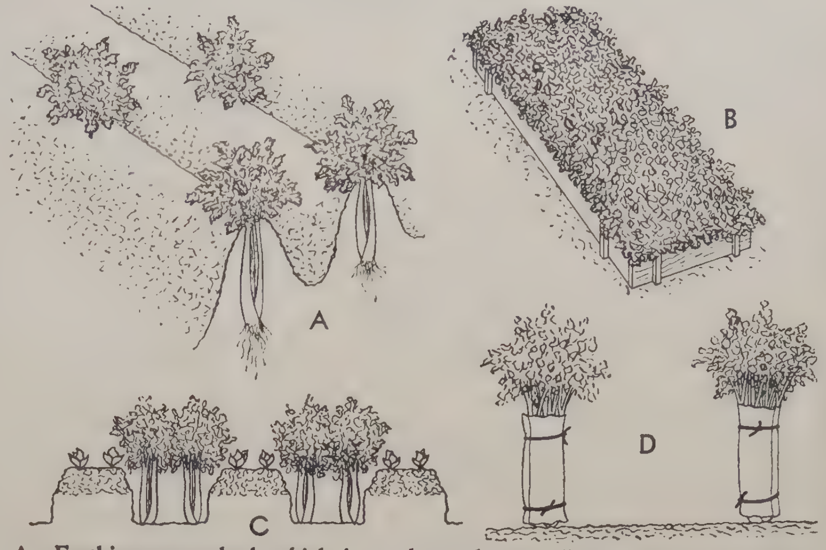
A trench in which it is intended to grow celery should be 12in. deep with a layer of stable or farmyard manure dug into the bottom and covered with 3in. of soil, into which the plants can be set 9in. apart. If the celery is to be grown in a bed, farmyard or similar manure should be incorporated or a fertiliser made by mixing four parts blood and bone manure, two parts superphosphate, and one part potash broadcast over the area at the rate of ¼lb. a square yard and worked into the soil after digging. As celery is also liable to attack by carrot rust fly, it should not be planted on a part of the garden which has just been cleared of a carrot crop affected by this pest. Damage is only rarely serious, but protection can be afforded by scattering horticultural naphthalene at fortnightly intervals along the rows at the rate of 4oz. to 20ft. of row. It should be applied regularly, as it is volatile and acts only as a deterrent. Do not apply within at least 14 days before harvesting or there may be some residual flavour of naphthalene after cooking. The fungous disease *Septoria* leaf spot, the symptoms of which are numerous black spots on stems and leaves which cause stunting or death of the plants, is the most serious disease of celery. Spraying should commence in the seed-bed and continue at intervals of 14 days (more frequently in wet weather) until the plants are covered for blanching. Freshly-mixed Bordeaux or one of the Government Certified copper fungicides should be used. If aphis is present, nicotine sulphate should be added at the rate of 1 fluid ounce to 4 gallons of spray. Established crops of celery must be kept adequately supplied with water; frequent liberal applications of liquid animal manure are a prerequisite of success in any but the most fertile and well-manured soils.

Celery varieties recommended are: Early, Golden Self Blanching; Late, Solid White.

Cucurbits

Trailing leaders of marrows, pumpkins, and cucumbers should be stopped (pinched off) to encourage the growth of laterals which bear fruit. The laterals can in turn be stopped to limit the number of fruit to the capacity of the plant. Cucumbers should not be left on the vines after reaching maturity or the flavour is likely to be bitter. Liquid manure is of special benefit for cucurbits and can be applied liberally at weekly intervals.

METHODS OF GROWING CELERY



A—Earthing-up method, which is rarely used now. It is suited to the older types of celery, now seldom grown, except in colder districts. B—Boarding-up method, which is more modern and suited to self-blanching types. C—Trench method. Lettuce or radish may be grown between the rows if space is lacking elsewhere. D—Covering with stout paper suits both main types of celery.

Peas

Except in a few favoured districts January is the latest peas may be sown to mature before winter. An early variety should be chosen and in most southern districts it is advisable to sow early in the month. Contrary to general belief, peas thrive best in cool weather. A cool, moist, well-drained loamy soil with a high humus content is preferred, though fair crops can be produced on almost all soils, except heavy impermeable clays and, in dry summers, light sandy soils which dry out. Soils which were heavily manured for a previous crop are usually suitable and 4oz. of superphosphate to 9ft. of row may be applied with advantage along the line of planting and well worked into the soil. A shallow trench should be opened up and in the bottom of it the seed can be pushed 1 to 2in. deep, according to whether the soil is heavy or light. One pound of seed will sow about 100ft. of row. Planting in double rows is not recommended. Though the dense haulms intertwining between the rows will assist in conserving moisture, earthing up, cultivation, and insect pest control are more difficult. The rows for dwarf varieties can be 20in. apart with the seed 2 to 3in. apart in the rows. Before sowing it is advisable to pick out any seeds which are badly discoloured, as they may be infected with the collar rot fungus or with bacterial spot. When seed sowing is completed the trench should not be filled but along it several handfuls of burnt lime can be thrown. This should provide protection from the birds and slugs. When the seeds germinate, but before the young leaves emerge, if another dusting of lime is given it should obviate the necessity for barricades of cotton or other devices to protect the seedlings from the birds. If a dwarf variety is grown, there should be no need to stake the plants; they can be simply earthed up as they develop. As the seedlings develop it is important to remove any plants which show signs of wilting or yellowing and are black on the stems. They may be infected with collar rot and if left will infect healthy plants. Good early-maturing varieties are Massey (syn. Kelveden Wonder) Little Marvel, and Blue Bantam.

Potatoes

The main potato crop should be kept moulded to as sharp a ridge as possible so that should the foliage be affected by late blight the spores will not wash through the soil and come into contact with the tubers underneath. The tubers themselves should be kept covered with a sufficient depth of soil to prevent attack by the potato tuber moth. A protective spray with freshly-mixed Bordeaux can be applied with advantage in districts where rainfall and humidity are usually high and where the crop is likely to be attacked by late blight. The period between sprays varies from two weeks (longer if the weather remains dry) in Auckland to four weeks

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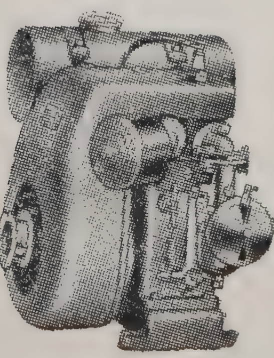

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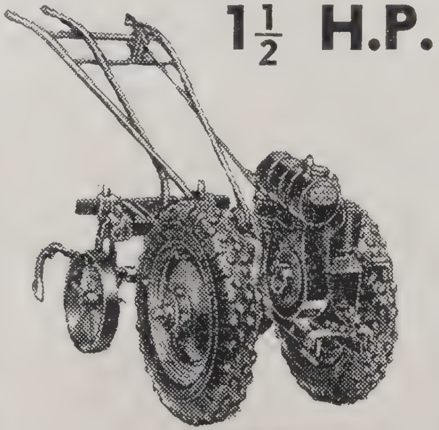

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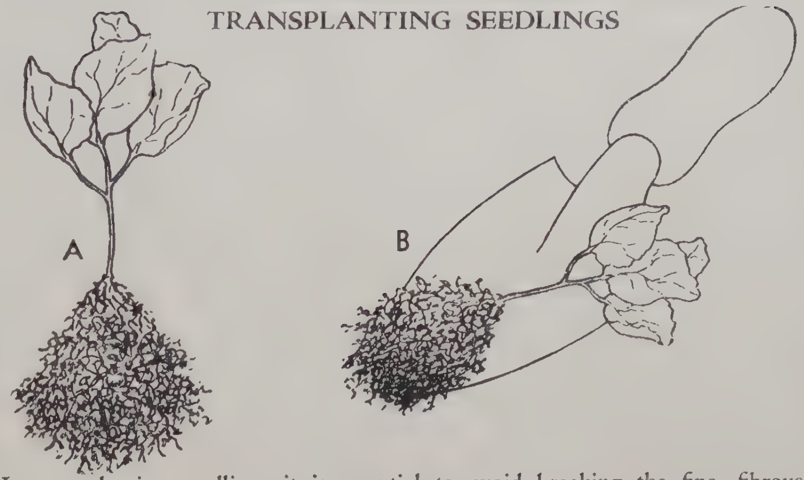


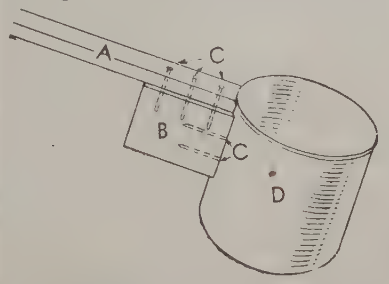
In transplanting seedlings it is essential to avoid breaking the fine, fibrous feeding rootlets. A—Seedling lifted with ball of soil. B—Seedling and soil lifted on a trowel ready for planting into permanent position.

further south. In the main potato-growing areas of the South Island late blight is only rarely troublesome and then not until later in the season, and spraying is seldom necessary. Should potatoes be badly blighted it is advisable to pull or cut the tops off and burn them and then not to lift the crop until at least 10 days after the haulms were removed.

Lettuce

The secret of producing crisp, tender heads of lettuce is quick growth. Lettuce which has remained unduly long in the soil before reaching maturity is usually tough and has a bitter taste. The soil should be well drained and cultivated and rich in organic matter. Well-rotted compost, stable or farmyard manure, or green manure crops dug in some time before planting are excellent. In addition it is advisable in most soils to use some quick-acting fertiliser. Blood and bone broadcast after digging and before planting at ¼lb. a square yard should give satisfactory results. After the plants have started to heart they will benefit from the application of nitrate of soda at 1oz. a square yard hoed in between the rows. It should not touch the foliage. Weekly applications of liquid animal manure may be substituted for the nitrate of soda.

LIQUID MANURE LADLE



A—Handle 4 to 5ft. long B—Wooden block about 3in. x 4in. x 1in. C—Nails. D—Can, preferably pint size or larger.

Where conditions are hot and dry it is usual to sow thinly ½in. deep in rows 12 to 15in. apart and later thin to 8 to 12in. apart in the rows; elsewhere seedlings may be transplanted. Plants remaining after thinning, like those just planted out, should be firmed and watered once.

Popular varieties of lettuce for sowing now are Webbs Wonderful, Imperial 847, Neapolitan (Summer Market), and Success. Great Lakes, a comparatively new variety, is claimed to have great merit for growing in hot conditions.

Radish

Maintenance of successional sowings of radishes is very important, as they do not "stand" long in the ground before deteriorating. For crispness and quality they should be grown quickly. The soil should be well drained, free, and contain plenty of humus. It should be moist at all times. Where the soil dries out the radish is likely to be tough and stringy and will quickly run to seed. If soil conditions are likely to be hot and dry, it is advisable to delay sowing. Radish seed can be broadcast, or sown thinly ½in. deep in rows 12in. apart. If the soil is not heavy and has been deeply dug and well worked before sowing, there should be no need to thin varieties other than the Chinese type, which often grows to up to 2lb. in weight and should be thinned to 6in. apart. Radishes are available in long, round, and oval varieties.

Shallots

The food value of the shallot is stated to be considerably greater than that of the onion, and considering the simplicity of its culture it is rather surprising that it is not more commonly grown in New Zealand. Most crops have attained optimum development by January and water should then be withheld and the bulbs permitted to dry off. If they are carefully harvested when properly dry and then stored in a cool place, they should keep until the following spring. It is important that they should be properly dried and sorted over before being stored. Bulbs that have been fed with excessive quantities of nitrogenous manures are difficult to harden off and should be kept for short storage; damaged bulbs should be used at once or destroyed.

Swedes

For the production of swedes of good quality conditions should be moist and preferably reasonably cool. Grown where conditions are too hot and dry the roots are almost invariably woody and tough. Swedes are principally grown for winter use and sowings should be timed to enable full development to be reached by the end of autumn. Good crops can be produced from sowings made from late November to January, the later sowings being preferred in the more northern districts. Satisfactory crops are grown on most types of soil used for vegetable production, but a moderately light loam which contains plenty of organic matter will give best results. Superphosphate at the rate of 1 to 2oz. a square yard is generally adequate as a fertiliser. The seed should be sown thinly ½in. deep in rows 12in. apart and the young plants later thinned 6 to 8in. apart. Varieties commonly grown in home gardens for table use are Laings Garden and Superlative. Quarter of an ounce of seed will sow about 100ft. of row.

Turnips

For good-quality produce it is essential that turnips, like radish, should be grown quickly. Soil should be well drained but moist and rich in humus and cultivated to a fine tilth. The crop can be grown on most garden soils, but a light loam is preferable. Superphosphate at the rate of 1 to 2oz. a square yard is a satisfactory fertiliser for most soils. In most southern districts or in areas where adequate soil moisture can be maintained January is a good time to sow. Elsewhere sowing is often delayed until cooler or more moist conditions are assured. Good varieties are Purple Top, White Milan, Purple Prince, and Golden Ball. A variety such as Golden Ball is usually chosen for December to February or March sowing, because yellow varieties usually "stand" longer under adverse conditions than the white sorts. Sow thinly ½in. deep in rows 12in. apart and later thin to 3 to 4in. apart.

Winter Greens

If not yet planted, leeks, brussels sprouts, curly kale, savoy cabbage, and broccoli (winter cauliflower) should now be set out. Leeks planted now should "stand" until late spring when varieties of savoy cabbage to mature successively until August or September are available; in a few districts late varieties of savoy set out late will provide good heads for cutting even beyond September. Late-planted brussels sprouts usually crop until about August, and curly kale a little later. The period varies a little according to district. Varieties of broccoli that mature at any given period from late autumn until late spring can also be set out.

The disruption of the supply of seed from overseas caused by the war has been especially felt by broccoli growers (much of the seed was produced by European countries), and disappointment resulting from the use of inferior seed caused many home gardeners to reduce or even cease the production of broccoli. An improvement, however, may be looked for in the future, as officers of the Agronomy Division of the Department of Scientific and Industrial Research are now working on the production of varieties of vegetable seed suited to specific New Zealand conditions.

All winter greens require a well-drained, deeply-cultivated soil rich in organic material. The addition of a fertiliser mixture made up of one part sulphate of ammonia, three parts superphosphate, and half part sulphate of potash, all by weight, dug in at the rate of ½lb. to each 9ft. of row, is advisable in most soils. Side dressings of nitrate of soda or sulphate of ammonia may be necessary later if growth appears slow. Leeks are usually set out 6 to 8in. apart in rows 12in. apart and brassicas about 18 to 24in. in the rows with the rows 2ft. to 2ft. 6in. apart, the distance varying with the variety.

Examples of varieties of cabbage and broccoli which should provide continuity of supply are (maturing times in parentheses): Broccoli: Early White (March-May), Mammoth Winter White (June-July), Lily White No. 2 (August-September), and Late Queen (September-October). Savoy cabbage: Omskirk Early (March-May), Drumhead (May-July), Omega (July-September).

Insure against a Potato shortage next year
PLANT AN EXTRA ROW NOW
ALL FOOD PRODUCTION HELPS BRITAIN !

Pest Control

To protect brassica plants the foliage should be dipped before planting into a mixture of 1oz. arsenate of lead, 1 teaspoon nicotine sulphate, 2oz. hydrated lime, and 5 quarts of water. (Quantities of ingredients may be increased or reduced proportionately according to requirements.) The arsenate of lead should first be mixed with the hydrated lime, then water added to make a creamy consistency. The rest of the water can then be added and the nicotine last. This mixture should be applied during the hottest part of the day. If no aphis is present nicotine can be omitted; similarly if the plants are not infested with caterpillars the mixture may be made without arsenate of lead. Spraying as recommended above should stop at least six weeks before harvesting, and if the plants are still infested with insect pests Derris dust can be used.

"Paranaph"

The formula for "paranaph" insecticide was given some time ago by D. K. Pritchard, late Instructor in Vegetable Culture, Wellington, but as it is said to be a highly-efficient aphicide and cheaper than other specifics it is repeated here:—

To one pint of water add 3½lb. soap (soft soap is preferred). Simmer over a fire with constant stirring until all lumps have disappeared and a perfectly uniform melt has been obtained. Add 6oz. of refined naphthalene and stir until dissolved. Remove from the fire and add 1 pint kerosene. Stir until well mixed. The finished product should be semi-solid and uniform in texture throughout.

It can be used at various strengths for aphides, scale insects, and fleas in buildings and on dogs. It is also very effective for cleansing the hands after they have been soiled with oily grease from handling machinery. In the home garden it can be used at a strength of 2oz. to 1 gallon of water for the destruction of aphides on all members of the cabbage family and other plants affected by this pest.

Greater Price Margin for Well-prepared Wool Clips

DURING the war there was a tendency on the part of wool growers to be neglectful in the preparation and get-up of their clips, probably because of insufficient labour and lack of sufficient inducement by way of differentiation in price between well-skirted and classed wools and partly-skirted or non-skirted wools, says a statement issued by the New Zealand Wool Disposal Commission. That neglect was still apparent last season, when auctions restarted, and it was reflected in the prices realised and the lack of demand for badly-prepared wools.

To encourage an improvement in the preparation of the clip, the commission's schedule of reserve prices for the coming season shows a greater price margin between well-prepared and classed wools and wools which have had little or no attention. The schedule has been prepared on such a basis that, if market prices fall during the coming season, resulting in growers depending on reserve prices for their return, the grower who pays careful attention to preparation of his clip will gain an advantage.

The North Island grower whose clip is too small to warrant classing is advised to keep out odd fleeces which are very much coarser than the bulk, along with yolk-stained, seedy, and cotted wools which are not typical of the bulk, thus making the line more attractive and even in quality and style.

Those recommendations apply to average-style clips and not to very inferior grades, notably bush-stained, very sandy, fern-stained, seedy, cotty, or poorly-grown (hairy) wools, and double fleece, which are in a separate category.

Contagious Abortion Vaccination

FARMERS are reminded that the closing date for receiving applications for the vaccination of calves against contagious abortion in 1948 is December 31. A late fee of 10s. will be charged for all applications received after January 15. Application forms are available at all veterinary clubs and offices of the Department of Agriculture. The charge will be 1s. 6d. per calf for the first 14 calves in any herd and 1s. 3d. per calf thereafter. Veterinary clubs will make their own arrangements for collection of fees, but applications to Inspectors of Stock must be accompanied by a cash payment calculated on the basis of the charges given above. As it may not be possible to vaccinate calves for which late applications are received, applications should be forwarded at once. Full details of the procedure for 1948 vaccinations were given in last month's issue of the "Journal."

FARM WORK FOR JANUARY

By the Fields Division.

JANUARY is a busy month for the farmer, particularly in arable districts; shearing, harvesting of grain and seeds, digging of potatoes, weaning of lambs, and intercultivation of root crops are but a few of the many seasonal operations.

AUTUMN-SOWN GRASS

At this time of the year the major cultivation work should be almost completed, and opportunity should be taken to harrow to consolidate the soil and kill weed seedlings. The type of seed mixture to sow must be adapted to the district, the soil type, and the purpose for which the pasture is sown. Where a dual-purpose pasture (for grazing and seed production) is intended a simple mixture such as ryegrass-white clover or ryegrass-red clover is usually sown. On the other hand a pasture intended for grazing only may contain a more complex mixture of grasses and clovers. Only good seed should be sown and on soils known to require lime this should be applied before sowing the seed.

Italian ryegrass or short-rotation ryegrass either alone or in combination with white clover or red clover may be sown this month or during February and March. Italian ryegrass or short-rotation ryegrass sown now will supply good feed for fattening lambs in April and May.

Areas in which it is intended to establish subterranean clover should be sown this month or during February and March. Old stands of subterranean clover which lack vigour should be surface worked and fertiliser and grass seed sown where necessary.

HARVESTING OF GRASS AND CLOVER SEED

Harvest grass seed and cocksfoot and white clover seed as the crops ripen. Seed of the ryegrasses should be allowed ample opportunity to mature in the windrow or stook before threshing, the interval between cutting and threshing depending on weather conditions. If threshed too soon there is always a danger of the seed heating in the bags, with consequent loss in quality and possibly also a lowering of the germination. Italian ryegrass and short-rotation ryegrass threshed too soon seem more prone to heating in the bags than perennial ryegrass. Signs of heating should particularly be watched for if the weather conditions before threshing have been unfavourable. If heating occurs the quantity of seed in each bag should be reduced and the bags hung on fences until all sign of heating has disappeared.

White clover seed crops are not normally cut until about 80 to 90 per cent. of the seed heads are brown and at least half the balance of the seed has assumed a yellowish tinge. Under very favourable weather conditions the proportion of ripe seed before cutting will usually be higher, but the reverse is likely to be the case if, as a result of wet conditions, crops continue to flower indefinitely.

Cocksfoot crops for seed should be cut when the bulk of the kernels are fully formed. It is a fairly difficult crop to thresh satisfactorily, and should be stacked or left in the stook for at least a fortnight before threshing.

A better pasture will result after threshing grass seed or clover seed if straw is removed from the paddocks.

HARVESTING OF CEREALS

Wheat should not be direct headed until the moisture content has dropped below 15.5 per cent. Most farmers are able to tell when the wheat has reached this stage, and it is only during unfavourable weather conditions that extensive use is made of the moisture-testing service provided by the Wheat Research Institute.

Oat crops on lighter land may be direct headed, but on heavier land the crop is better windrowed before threshing, or cut with the binder, stooked, and later threshed from the stook or stack. A crop for chaff may be cut at a slightly greener stage than one harvested for grain.

Barley for malting may be direct headed, windrowed, or picked up from the windrow, or it may be cut with the binder and either threshed from the stook or stacked and later threshed from the stack. In threshing barley it is important to avoid injury to the grain, which affects the germinating capacity of the line, while cracked, skinned, or broken grains adversely affect the quality of the malt. A little of the awn should be left on the grain.

INTERCULTIVATION

Mangolds, swedes, chou moellier, and turnips sown in wide rows may be intercultivated. If weather conditions permit, the initial intercultivation should be carried out when the weeds are in the seedling stage. It is not only most desirable to prevent smothering of the young crop by excessive weed growth, but weeds are more effectively controlled if tackled when small. After weeds have reached a certain size there is no alternative but to hand hoe and hand weed.

Main-crop potatoes in the South Island will also require intercultivation and final moulding of the crop before growth of tops becomes too rank.

LAND PREPARATION

Skim plough out of grass for wheat and during hot, dry weather cultivate skimmed land to destroy Californian thistle and any of the various twitches. Land for sowing in greenfeed oats, barley, and lupins for autumn feed should be given a final preparation and final breaks of turnips for winter feed sown.

IRRIGATION

The sowing of lucerne on areas bordered for irrigation may be carried out from mid-January, although frost-lift of lucerne plants may be severe in crops sown after mid-February. The rate of sowing for lucerne is 13 to 16lb. an acre, and drilling should be done across the borders to obtain an even strike on the dikes or ridges. The second cuts of established stands of lucerne should be taken as soon as new shoots appear from the crown of the plant, as later cutting will sever these shoots, which are the nucleus of the third cut.

Pasture areas on irrigated farms may be sown at the same time as lucerne, but under favourable conditions sowings may be made a little later. As a basis for a grassing pasture under irrigation the following mixture is suggested:—20lb. Certified perennial ryerass, 5lb. timothy, 1lb. dogstail, 2lb. Certified white clover, and 1lb. Certified Montgomery red clover.

STOCK NOTES

Weaning of lambs will be general in early-lambing districts this month. All lambs at weaning time should be dipped, crutched, eye-clipped if necessary, and drenched for parasites, and put on to a pasture that has been spelled for some time to clean it of foot-rot and parasitic infection. Stubble paddocks from recently-threshed crops are excellent for fattening newly-weaned lambs. Where rape is the fattening feed the crop should not be too green when the lambs are put on. Breaks of rape should not be too large; areas that necessitate the lambs going to a clean break every 15 or 16 days are advisable, as the risk of parasitic infestation is then greatly reduced.

After the weaning of the lambs cull ewes should be taken from the flock; any that are ready for the butcher should be sold and the rest put on fresh feed for fattening.

Calves for herd replacements should be kept on clean pastures with access to plenty of water.

The milking herd should also have access to water, preferably running water, at all times.

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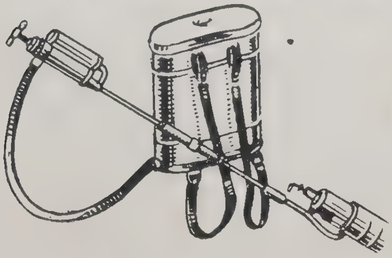

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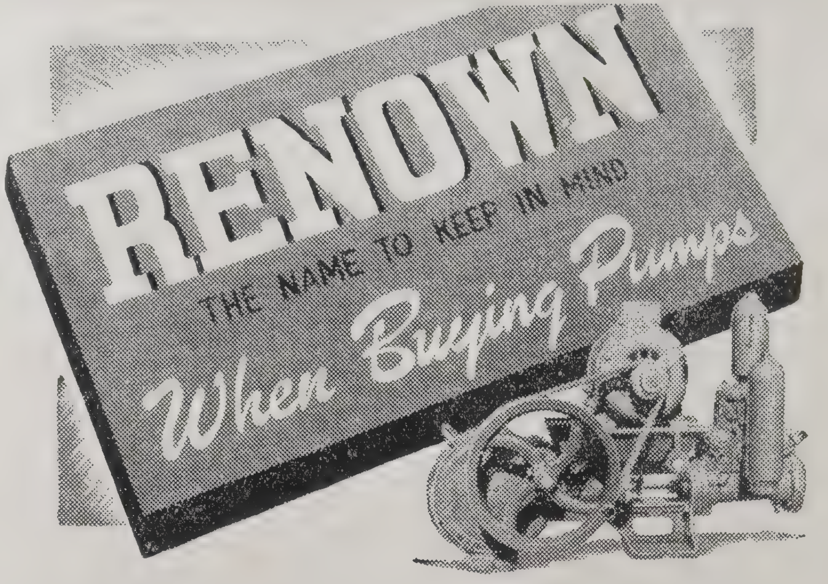

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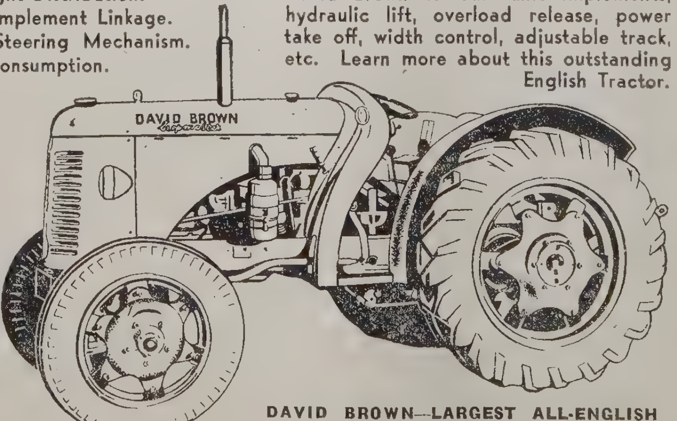

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PITS FOR SILAGE

By J. E. BELL, *Fields Superintendent, Auckland.*

SILAGE is made in pits to save waste and to save the work involved in stacking the material. A very well-built and well-covered stack made from young, succulent material will have only 3 to 6in. of waste at the sides, but an average stack of the same material has 12in. of waste at the sides and 2 to 3in. under the earth seal. With dry material the waste is usually 2ft. at the sides even if building and covering have been well carried out. With a stacker most of the drudgery of stacking is obviated, but the operation of a stacker requires a gang of men, involving the employment of extra workers or obtaining them by co-operation. By using a pit the work can be carried out between milkings by the hands on the farm, assisted if necessary by one extra hand.

THE stack has the advantages over the pit or silo that the farmer may save fodder from any field on the farm and feeding out is easier, but on farms where pits can be constructed which are easy of access for filling and carting out, and particularly if the subsoil is such that the walls do not crack when the pit is empty, a pit or pits should be constructed because of the saving in waste and ease of filling at harvesting time.

Permanent overground silos of wood or concrete have the disadvantage of the pit in fixity without its advantage in labour saving. They are also costly to construct, and that factor is the main one debarring their use.

The site selected for a pit should be accessible for filling and emptying. If access is bad for emptying, the farmer may have to fork large amounts of silage over the sides when the entrance becomes bogged with the daily traffic of cart or sledge during wet weather. If access is likely to be poor, pits should always be made shallow in case the material has to be forked out.

Pits should not be dug below the height reached by the water table in the wettest period of the year. If a spring is struck during construction, the pit should be filled in and a drier site chosen. In some districts, such as Rotorua, where soils are particularly well drained a trench may be dug on level ground 4 or 5ft. deep without striking the water table or springs, but in most dairying districts a more elevated site is necessary. A tableland is best because less excavation is usually necessary and level ground is available at the higher level when filling and at the lower level when emptying the pit. If a pit is constructed opening into a gully, the silage usually has to be carted out uphill on a specially-constructed track, and consequently carts or sledges cannot be well-filled; frequently conditions are so bad that the material has to be forked up over the sides. If a tableland of the required height is not available, a hillock may be chosen, or a ridge may be available through which a trench can be constructed by plough and scoop or bulldozer.

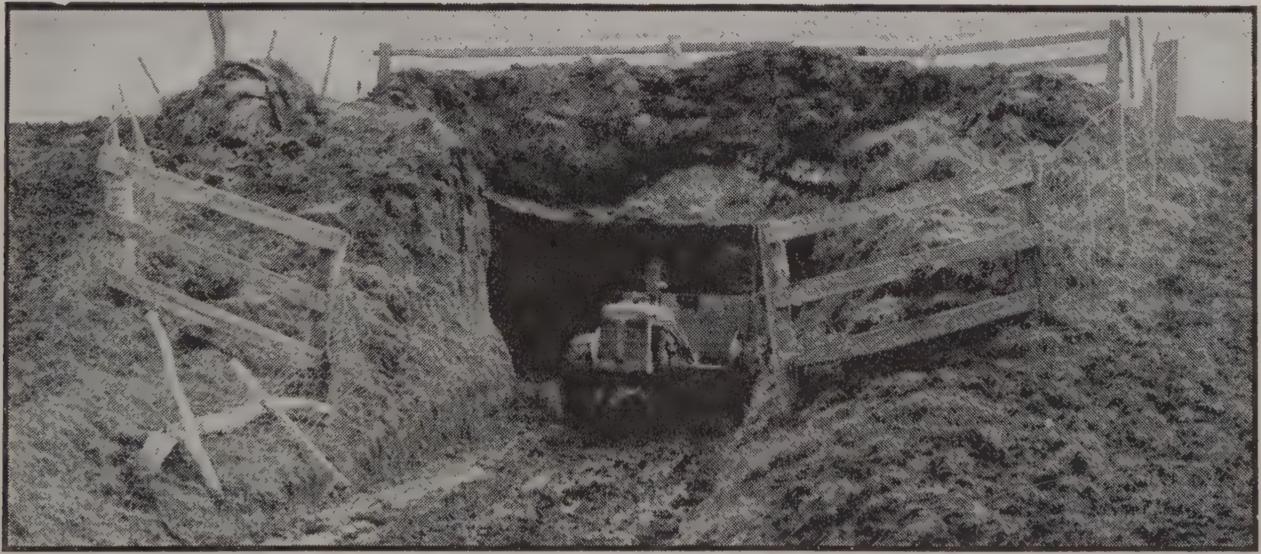
Pits and trenches should be accessible to two or more fields so that their use does not involve the cutting of the same area for silage every year. Unless the field is shut up for only a very short period, deterioration of the pasture is certain to follow cutting for silage year after year.

A pit should be large enough to contain the material so that it sinks into the pit, lessening waste and the difficulty of filling.

A farmer can usually judge approximately the amount of hay which could be produced from a crop of grass. That figure multiplied by three gives the yield of silage in tons. An acre of fairly-good grass will produce about 7½ tons of silage, cereals and tares about 9 tons, and maize about 30 tons.

Silage in the pit varies in density with the moisture present and the compression. One cubic foot may vary in weight from 30 to 60lb.—nearly as heavy as water—so a pit 6ft. deep and 21ft. in diameter would hold between 25 and 50 tons.

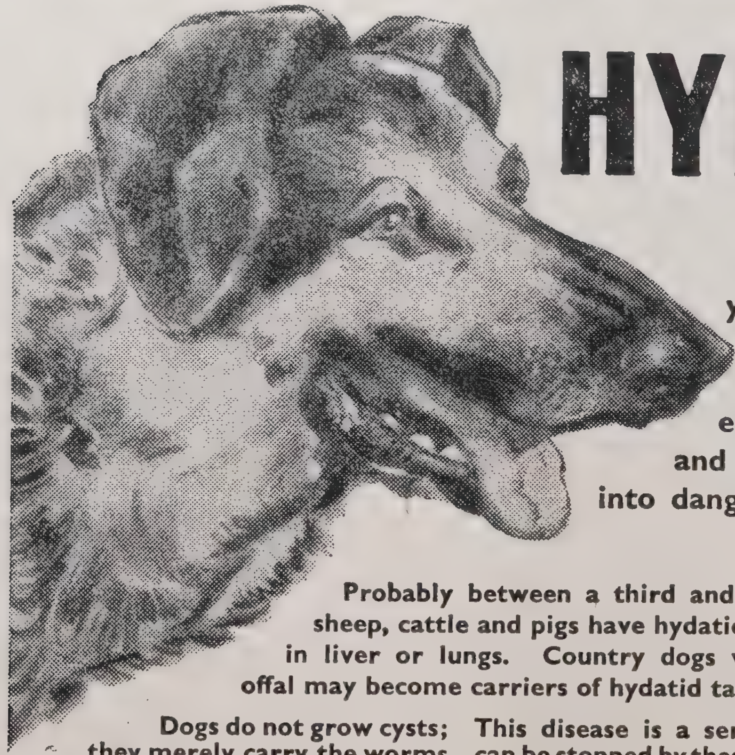
While being ensiled the green material loses moisture and dry matter through heating and consequently tends to occupy less space. In a perpendicular-sided pit or silo this shrinking tends to result in the formation of an air space between the walls and the material, which, as silage decays where it is in contact with the air, is likely to give rise to waste. In a pit this



[*Sparrow Industrial Pictures Ltd. photo.*

A round earth pit about 17 years old, photographed in August. The walls have a slight batter, and the entrance to such a pit should be metalled or concreted.

How your dogs can spread HYDATIDS



Dogs are our faithful friends, yet about 50,000 country dogs in New Zealand are infected with Hydatid tapeworms whose tiny eggs are passed on to human beings and stock animals and may develop into dangerous cysts.

Probably between a third and a half of our sheep, cattle and pigs have hydatid cysts, usually in liver or lungs. Country dogs which feed on offal may become carriers of hydatid tapeworms.

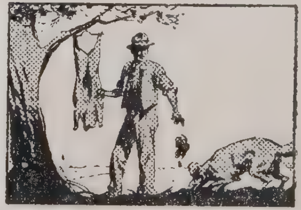
Dogs do not grow cysts; they merely carry the worms whose eggs are scattered by the million in their droppings. These droppings dry, crumble, and the eggs are blown about as dust. This dust gets on to pastures and infects sheep and cattle, and on to the coats of dogs, and so on to human hands.

These invisible eggs may thus get into the system, burrow through intestine walls into the bloodstream and so to liver, lungs, and even to heart and brain, where they may grow for years into dangerous cysts that can only be removed by operation.

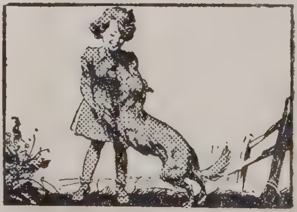
This disease is a serious one, and can be stopped by these precautions:

- After handling animals, never put hand to mouth without washing. Children should wash hands before every meal.
- Wash carefully all vegetables eaten raw.
- Never throw raw liver or lungs of sheep to dogs. Cut offal into slices and boil first. Otherwise burn or bury it.
- Dose your dogs with a vermifuge every three months and expel the worms. Arecoline is supplied for this purpose; it can be obtained with your dog licence.

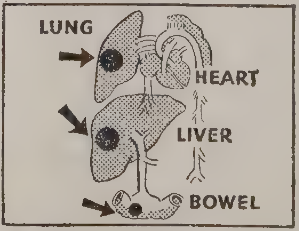
DOSE YOUR DOGS REGULARLY
Don't feed them raw offal!



Dog eats raw offal, becomes infected with hydatid worm.



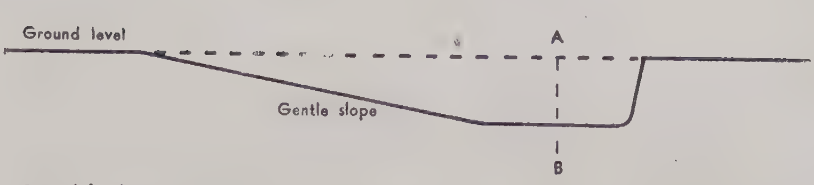
Invisible eggs from dog's dusty coat get on to child's hand and thence to mouth.



Eggs may lodge in human body for years, grow into large cyst.

can be overcome by battering the sides so that as the material sinks it maintains contact with them. The batter need be only slight—1 in 10 is ample.

TYPES OF SILAGE PIT



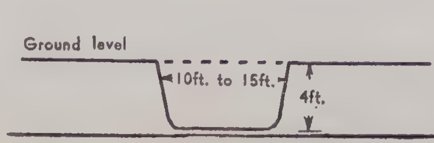


Fig. 1—Above: Side elevation of a trench on level ground. Left: Section through AB.

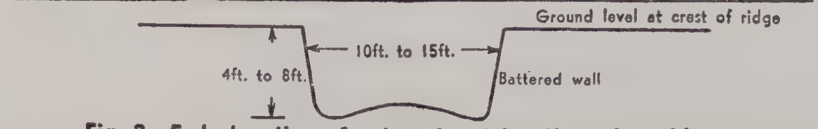


Fig. 2—End elevation of a trench cutting through a ridge.

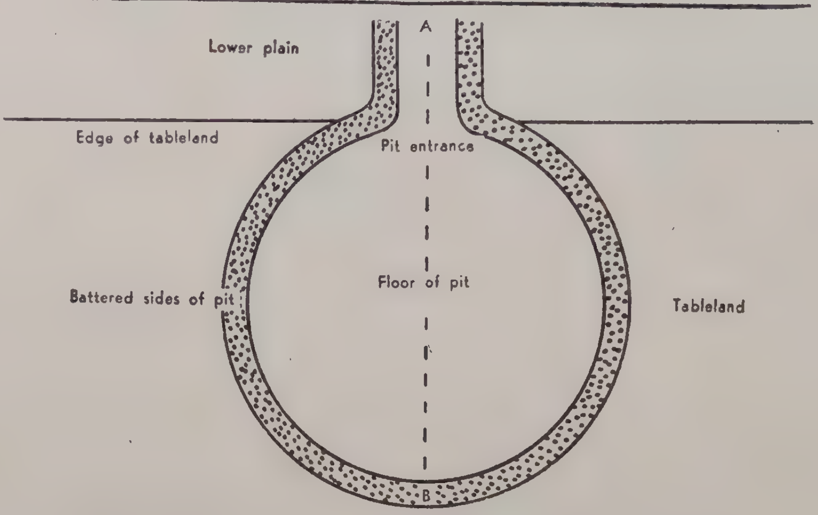
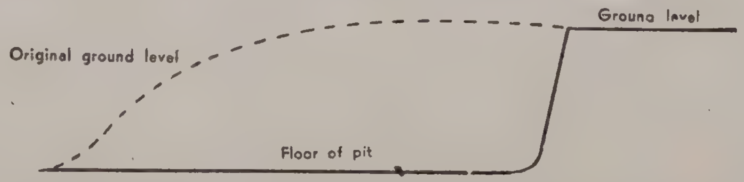


Fig. 3—Above: Plan of a pit silo. Below: Section through AB.



Trench on Level Ground

Fig. 1 illustrates the formation of a trench on level ground with one entrance for emptying. Entrances may be made at both ends, and these should be metalled, as should the portion of the bottom of the pit on which sledges or carts will stand during emptying operations. The bank at the sides of the trench can be raised by depositing the excavated material there, but that is not advisable, as it interferes with filling operations. The trench can be made mainly with a plough and scoop.

If the trench is filled with a tumbler sweep, once the portion at the back is filled the loads can be carried right on to the place where they are to be dumped and the horse can go straight ahead, leaving the trench at the opposite end. If that is done, very little work is required in the pit and only one man is needed. The requisite consolidation is obtained by the horse, sweep, and man travelling from one end of the trench to the other during filling.

The main objections to this type of trench are that, even with an entrance with a slight slope, emptying is difficult and, if a horse sledge is used, it has to be pulled back by hand a long way before filling can be started. Altogether it is a type of pit recommended only where the topography does not suit the construction of other types of pits and only where the water table never rises within 5ft. of the ground surface.

Trench Cutting

A trench cutting (Fig. 2) is made by cutting through a ridge, just as a road cutting is made, leaving battered walls and a metalled crowned roadway sloping from the centre of the pit to each outlet to facilitate drainage. It is easily constructed with plough and scoop. It can be partly filled by using a tumbler sweep in the same manner as the trench below ground. If the trench is long and a horse sledge is used, pulling the sledge back by hand causes some difficulty in emptying.

Its advantages over the pit are ease of construction and the provision of alternate ends for emptying, but it is better to choose a readily-accessible site for a pit than to construct a trench in a less accessible place.

Pit Silo

A round pit in a tableland is shown in Fig. 3. The entrance is narrow to prevent the material surging forward and can be boarded up to hold the silage tightly in place; that is hardly necessary, though tight boarding would save the small amount of waste material exposed at the entrance. Pit silos can be any size and are usually from 10 to 25ft. in diameter and from 6 to 20ft. high. The entrance should be made in proportion according to the diagram, but wide enough for the sledge or cart to pass in and out.

The plan of the pit may be varied from round to a long ellipse, but corners should always be rounded off. For drainage the floor of the pit slopes down to the entrance, which should be metalled. If access for emptying is likely to be unsatisfactory, the pit should be made not more than 8ft. deep so that as a last resort the silage can be forked over the sides.

Advantages of Pit

The filling of pits or trenches need not be carried on as quickly as harvesting into stacks, because there is less air circulation to cause heating, especially when the horses in delivering the loads trample over the harvested material. Because of the lower temperatures silage in pits is usually superior to that made in stacks.

Silage in pits has been claimed to last 50 years. During the war period one farmer in the Patumahoe district could not save silage because of lack of labour. Silage made in a pit before the war was not required until the drought of 1946, when the pit was opened and the contents found to be in splendid condition. Truly it can be said of the silage pit that it is a savings bank for fodder to be drawn on in times of scarcity when all else fails. Unfortunately silage in stacks deteriorates more quickly than in pits, and the stack is therefore not such a good bank as the pit.

MARKET GARDENER'S & SMALL

1

By F. L. BAILEY, *Orchard Instructor, Palmerston North.*

THERE is a diversity of machinery at present available for the market gardener and small fruit grower; in fact the range of small tractors and light equipment is so wide that the selection of a tractor with capabilities to suit a grower's particular purpose is not always easy. The labour-saving features and multiplicity of functions of a variety of small tractors were demonstrated at Massey Agricultural College, Palmerston North, to several hundred interested spectators.

THE truth of the old saying "necessity is the mother of invention" has been amply demonstrated in recent years in many spheres of industry, where man's inventive genius has enabled him to achieve what at one time seemed impossible. Scientific research and the sound practical knowledge of the engineer and factory worker are producing today many machines and labour-saving devices the functions of which were looked upon a few years ago as being almost incredible. Now, however, they are accepted as essential for progressive and efficient working.

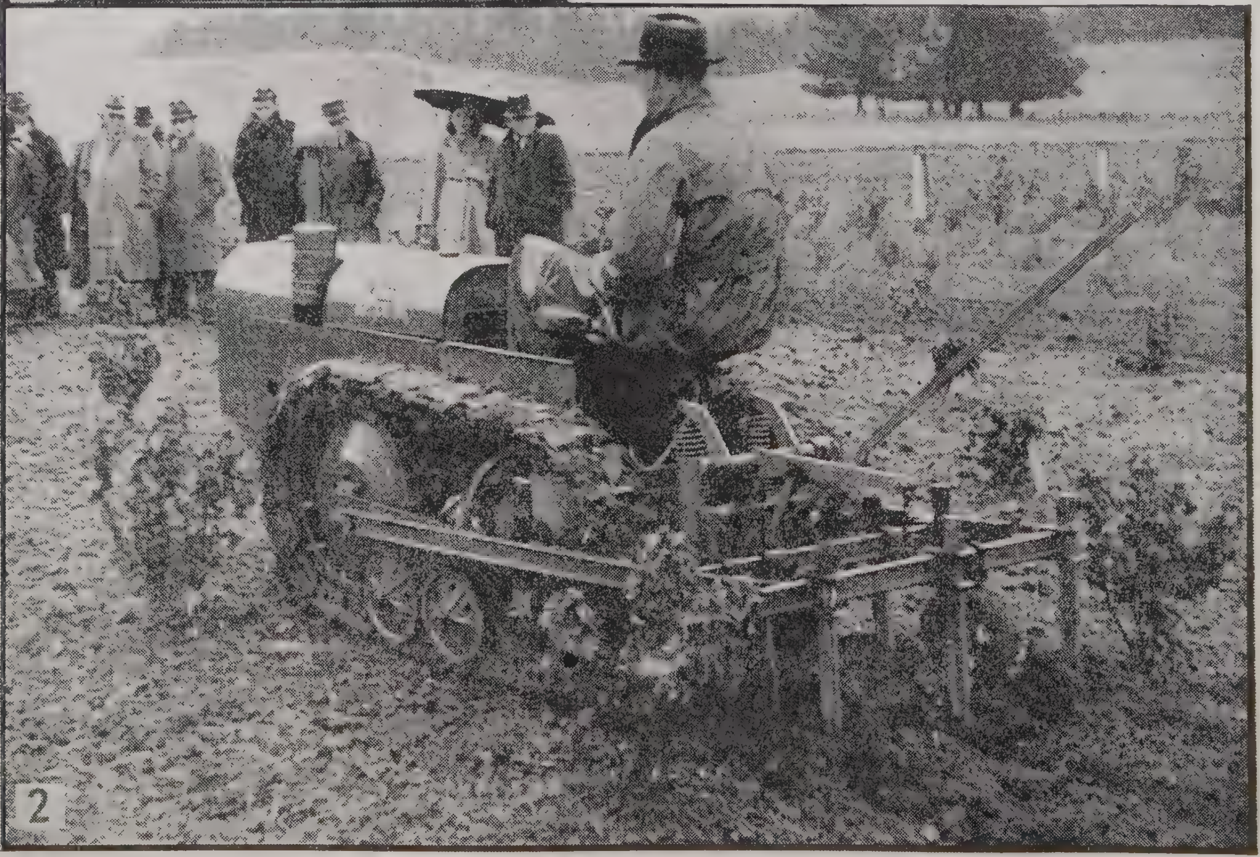

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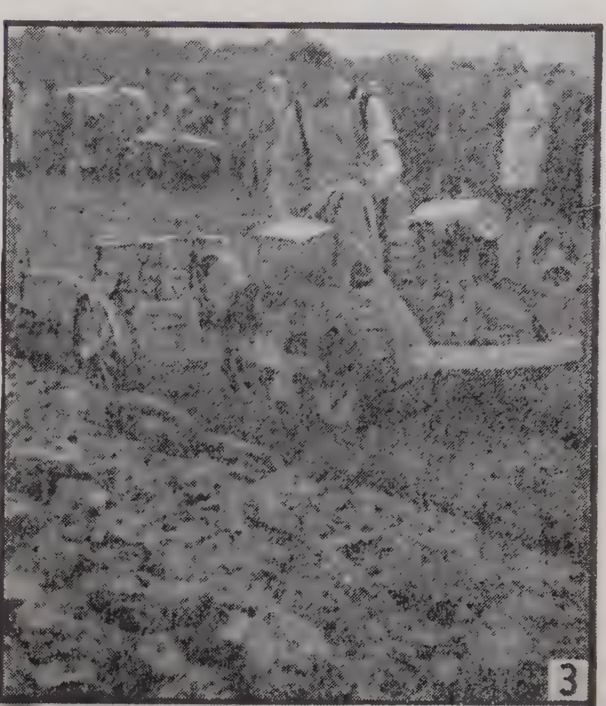
Fig. 1—A British crawler type tractor ploughing stiff pasture land. Fitted with a 10 h.p. four-cylinder power unit, it is capable of undertaking moderately heavy work. It is 36in. wide overall, 44in. high, and can be turned in its own length.
Fig. 2—The same tractor fitted with a cultivator attachment working in a plantation of currants. The cultivator bars may be constructed to any width to correspond with inter-row planting distances of any particular plantation.

FRUIT GROWER'S MACHINERY

It is not so long ago when horse-drawn implements were a familiar sight in market gardens and small fruit holdings. The horse was, in fact, the main source of power for many years in most farming operations. The necessity for increased food production during the war provided an impetus to machinery manufacturers, particularly in Britain, to produce new machines and improve existing models to cope with the ever-increasing demand for food. The demonstration at Massey College provided an excellent example of what wartime inventive genius has done for the market gardener, nurseryman, and small fruit grower. A number of the machines were post-war models, and some had arrived from Britain during the early months of this year.

The changing need of the times, calling for continued cropping and recropping, has caused the primary producer to replace his horses by the quicker and more efficient working of the tireless machine. The advantages modern machinery has over the old methods of horse-drawn implements in the tillage of the soil and maintenance of growing crops are well known to growers. Two other important factors worthy of consideration, however, are the increased efficiency in the working of an economic unit and the saving of labour, which under present-day conditions make the use of mechanical equipment practically indispensable.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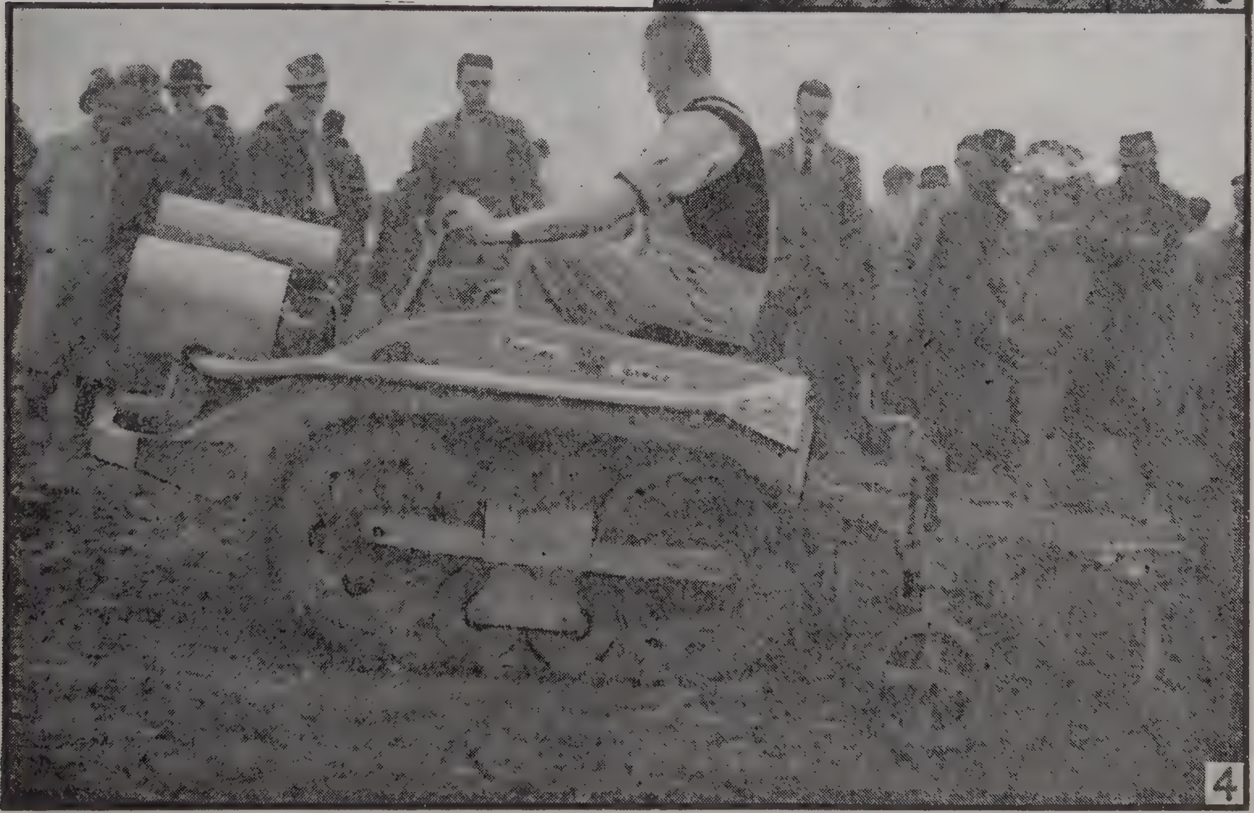
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Fig. 3—A British "baby" track type tractor operating a plough on land in pasture. It is fitted with a 6 h.p. single-cylinder, air-cooled power unit. The engine is a self-contained interchangeable unit which can be taken out by removing four bolts and disconnecting the throttle cable and exhaust pipe. The tractor is 3ft. 5½in. wide, 3ft. 4in. high, and 5ft. 10in. long. Fig. 4—The same tractor fitted with a cultivator attachment. Owing to its size and ease of handling, it is capable of performing many types of cultivation work in confined areas.

The availability of labour is a problem to which almost all classes of industry are unable to find a solution, and the market gardener and small fruit grower are not relieved of this difficulty. Mechanical implements assist to a large extent, for the speed with which operations are performed allows greater elasticity of available labour than was the case before machinery was used. In addition growers are able to use their labour on a particular crop at the psychological moment, thus reducing production costs.

Machinery Demonstrated

The demonstration was confined to relatively light equipment mainly suitable for the use of the smaller market gardener, nurseryman, and berry fruit grower. Small wheeled tractors ranging from 1½ h.p. to a 10 h.p. crawler type tractor with narrow tracks, together with various cultivating attachments, were assembled from many parts of the North Island. Unfortunately weather conditions were poor, and a full demonstration of all equipment was somewhat curtailed. The demonstration, however, gave ample evidence of the multitudinous duties which the modern tractor can perform.

For the small man the most useful tractors are those capable of performing more than one operation and which are easily and swiftly adjustable to various purposes. That manufacturers of modern garden tractors have taken this

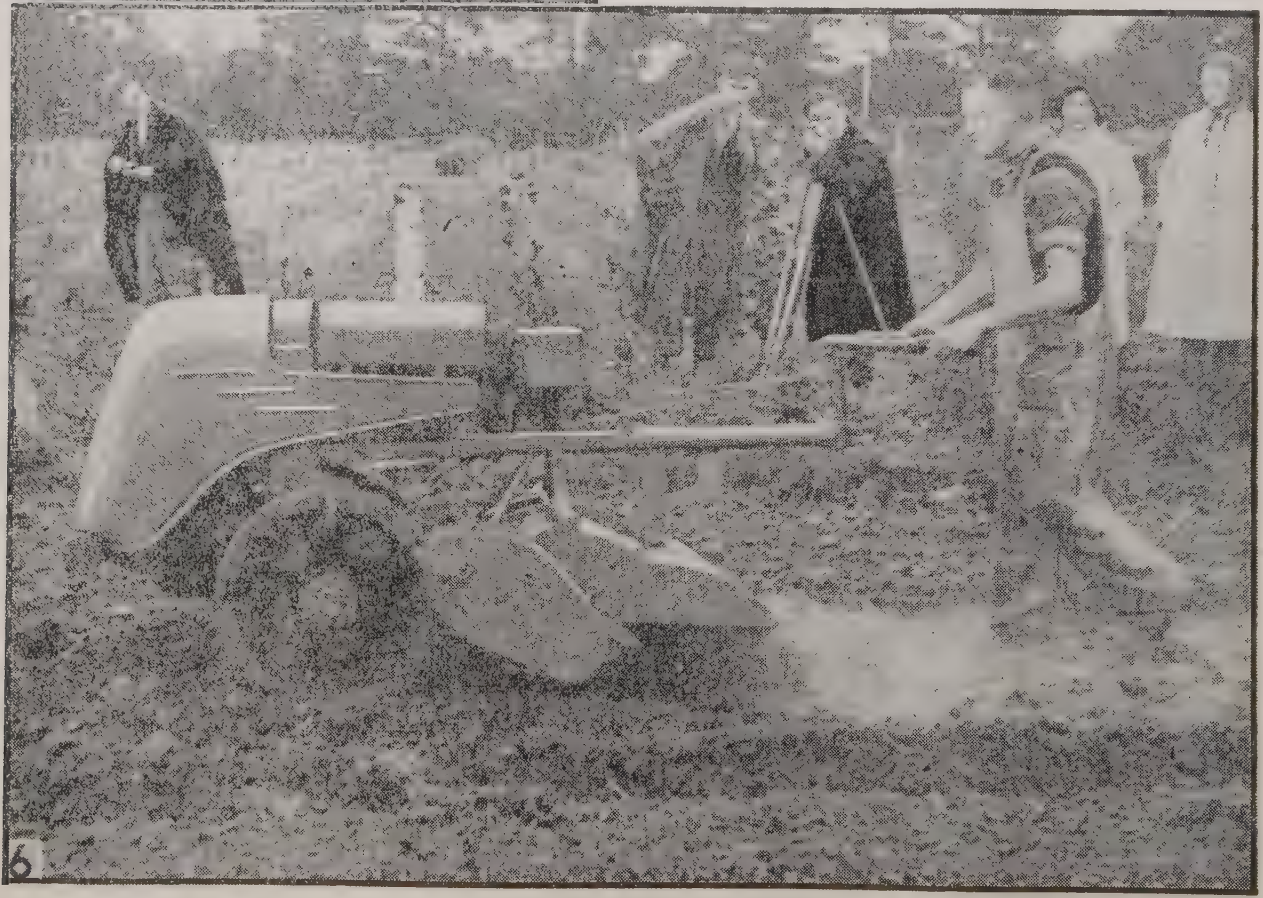


Fig. 5—A light British 3 h.p. tractor on rubber tyres operating with a plough attachment. Several other attachments may be fitted for various types of cultivation work. It is powered by a single-cylinder, four-cycle, air-cooled engine manufactured by world-famous industrial engine builders. Fig. 6—An Australian-built rotary hoe fitted with a 12 h.p. twin-cylinder engine. It is a useful implement for general maintenance cultivation and the preparation of seed-beds, and is worked on the principle of revolving knives which pulverise the soil.

fact into consideration was evidenced by the relatively short time taken to change over the various attachments. The disengaging of a cultivator and refitting with a sickle mower or other attachment occupied only a few minutes, after which the machine was fully prepared to undertake work of an entirely different nature. The versatility of modern machinery is of great benefit to the grower, for once he purchases his power unit, appropriate attachments may be obtained from time to time to meet his particular needs.

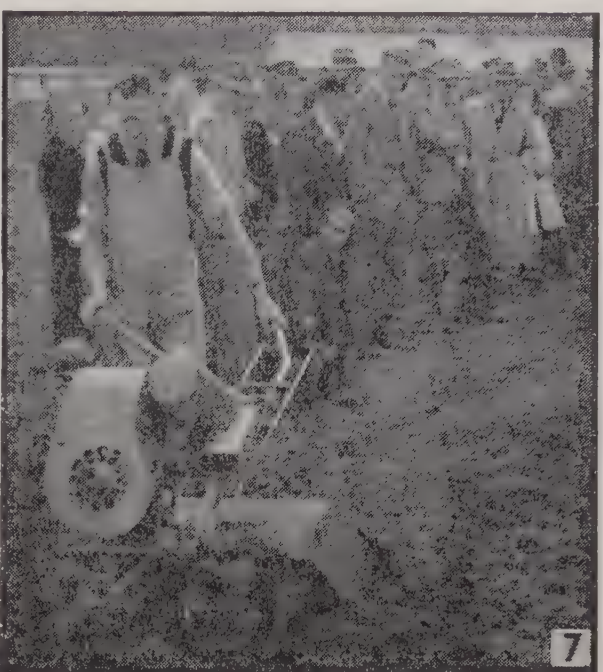
The illustrations accompanying this article show the tractors and attachments demonstrated and the many types of work they are capable of performing.

There is a tendency for some growers to use small, low-powered tractors on heavy cultivation work for which they were never designed. The result is invariably unsatisfactory tillage of the soil and possible permanent damage to the machine. A tractor will perform satisfactorily only those operations for which it was designed.

To ensure payable and trouble-free operation a machine should be correctly used and regular and thorough maintenance carried out. On small holdings where the permanent use of high-powered equipment is not warranted for the efficient working of the unit a contractor should be engaged once a year to do the heavy cultivation.

Photographs by Bell's Photo Service and Elmar Studios.

(Further illustrations of this article appear on the following three pages.)



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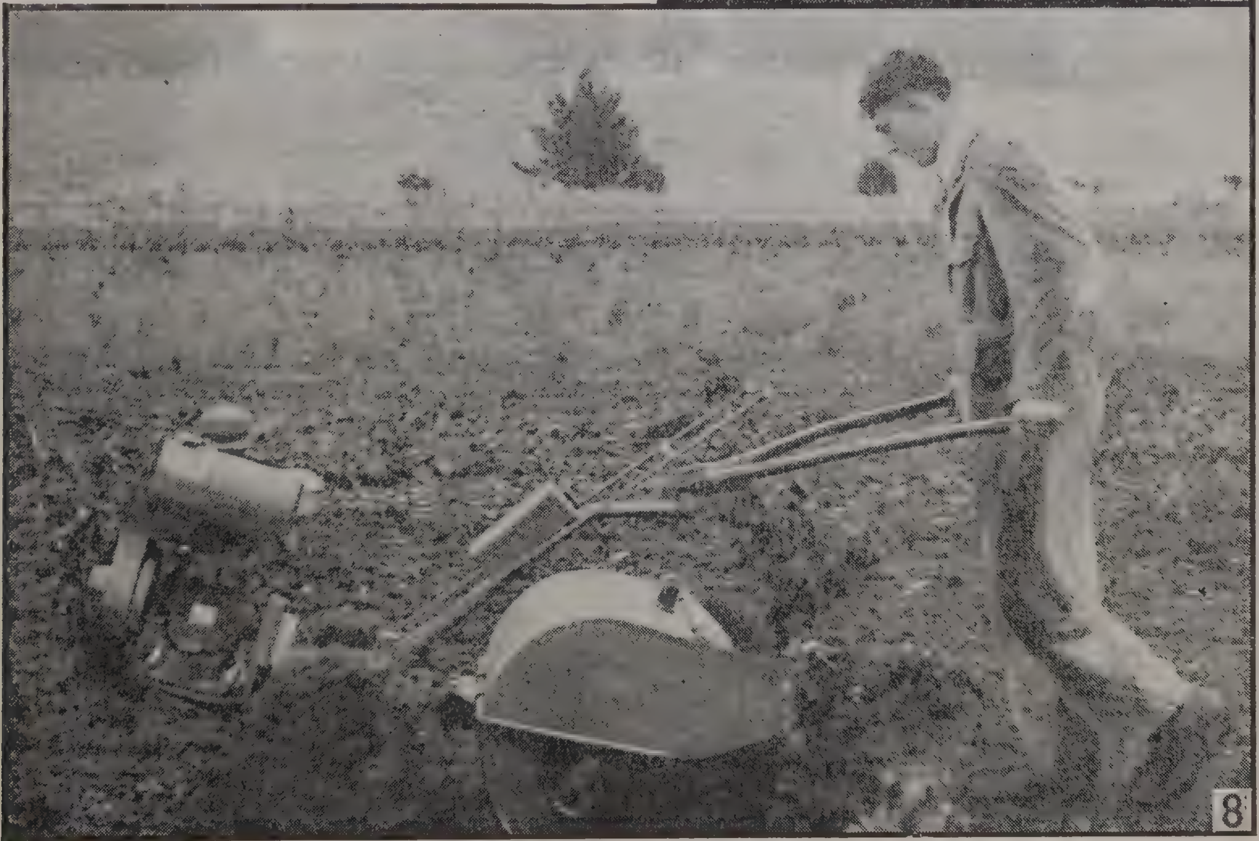

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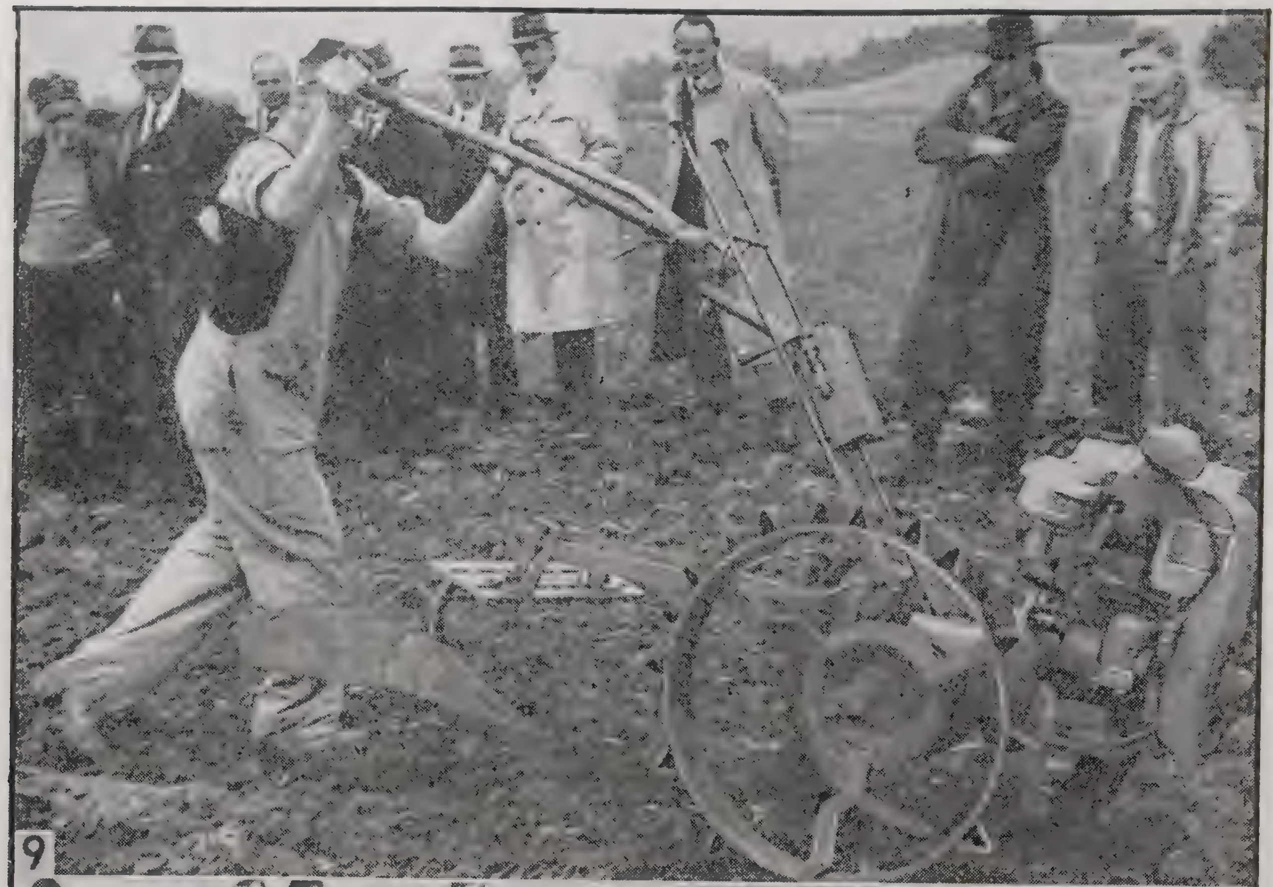
Fig. 7—A British-made rotary cultivator preparing a seed-bed of fine tilth. Note the position in which the operator is working the cultivator. Three positions are available on the steering arm so that the operator may walk behind or at either side of the machine at choice. Fig. 8—The same machine performing inter-row cultivation in a block of young currants. It is powered by a single-cylinder, four-stroke, air-cooled engine of 400 c.c. capacity. The rotary cultivator may be completely removed from the power unit by the removal of two ½in. nuts, which is an extremely simple operation.



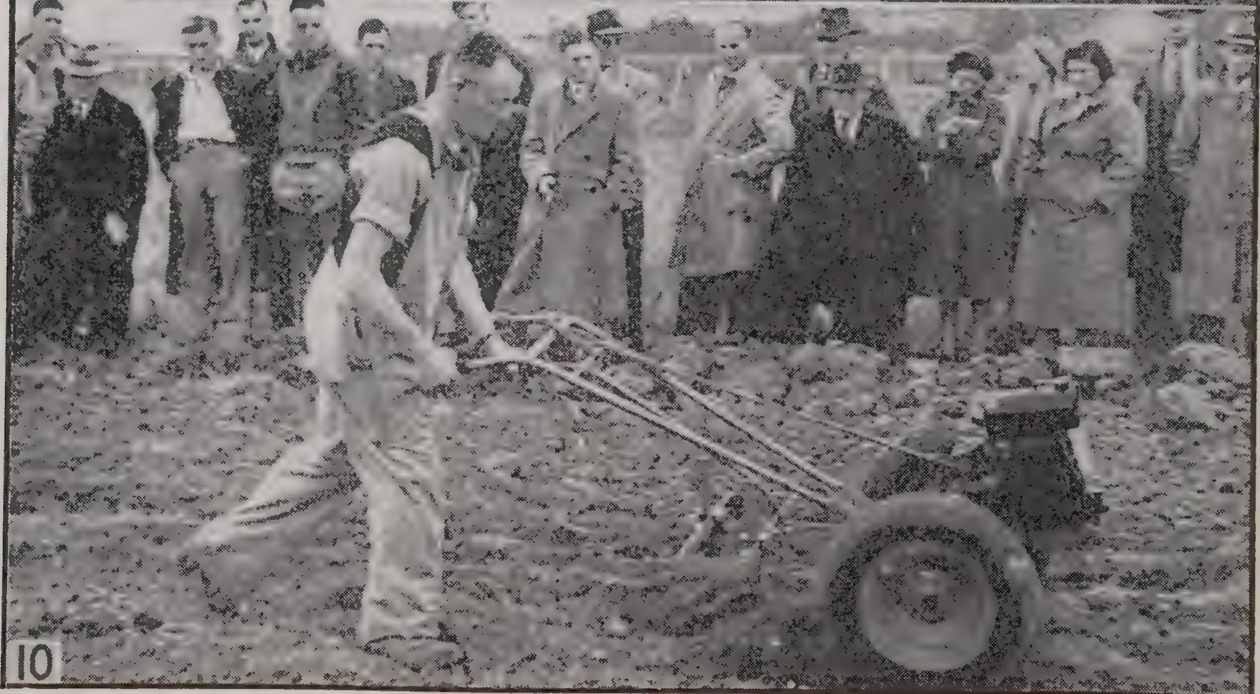
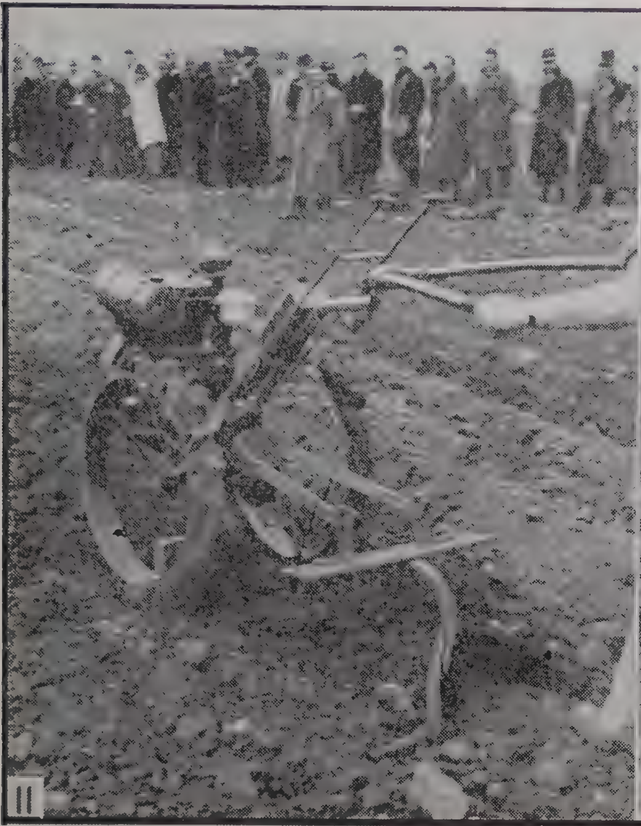


Fig. 9—A simple ridge plough attachment suitable for sowing and moulding up potatoes or similar work fitted to the machine in Fig. 8. Fig. 10—A small 1½ h.p. tractor fitted with a cultivator useful for inter-row cultivation to suppress weed growth.



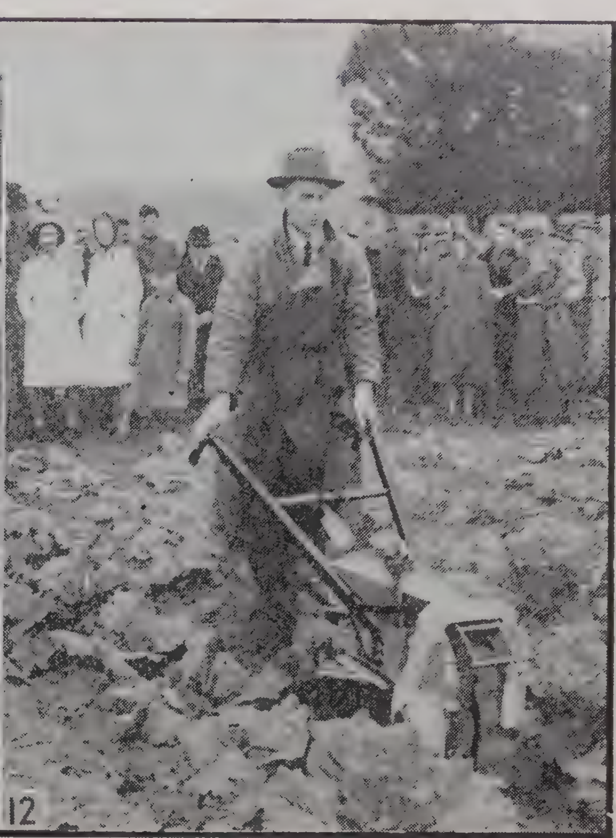
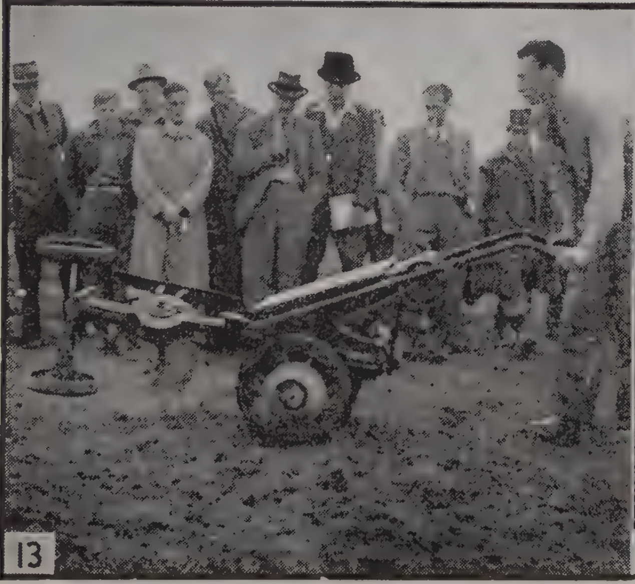


Fig. 11—A close view of the machine in Fig. 9 fitted with the ridge plough about to open up a furrow. Fig. 12—Another small 2 h.p. tractor of American design fitted with a tine cultivator attachment suitable for working between narrow rows of vegetables.



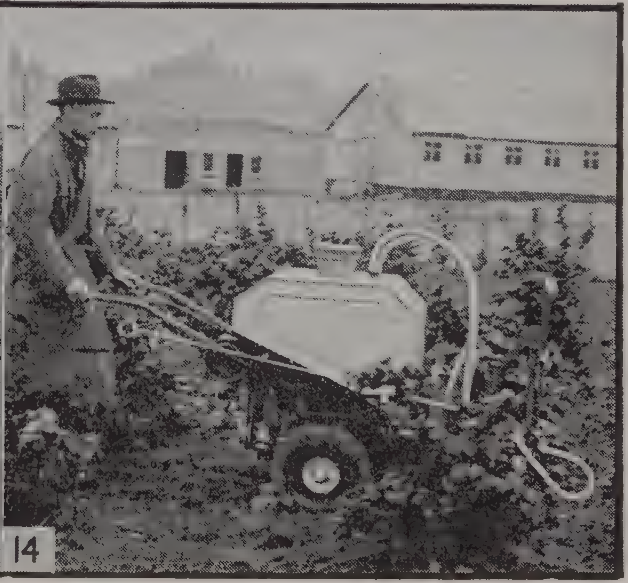
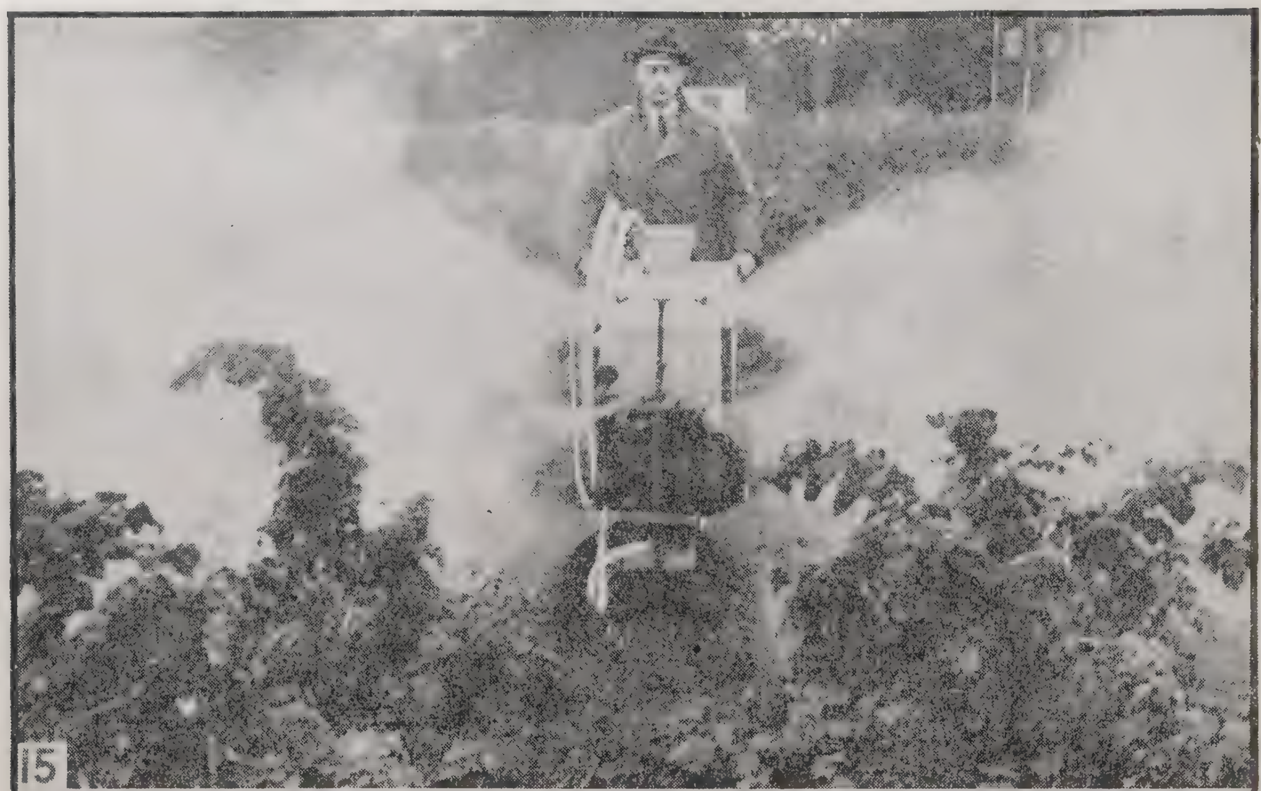


Fig. 13—A 5 h.p. American tractor fitted with a rotary plough. This attachment pulverises the soil and at the same time can prepare a raised seed-bed. A number of attachments including a cultivator, transport truck, sickle mower, roto-mower, and sprayer may be fitted to this tractor in a few minutes by the removal of four bolts. Fig. 14—The same tractor fitted with a spraying outfit.



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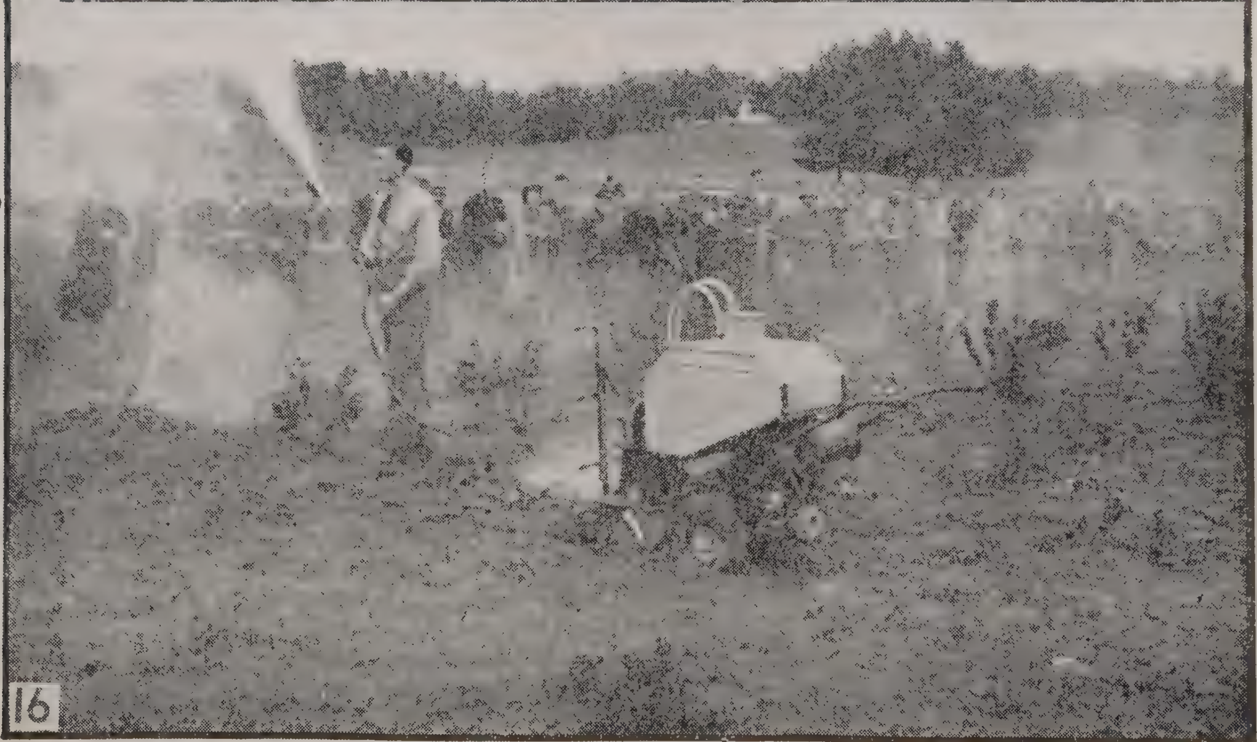

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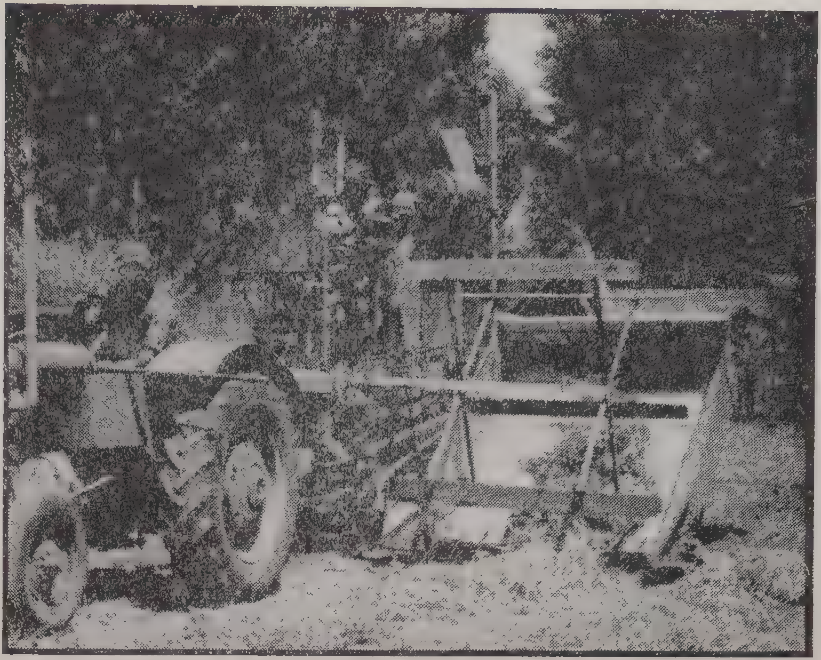
Fig. 15—The machine in Fig. 14 operating as a portable spraying outfit in a block of raspberries. Fig. 16—The same tractor operating as a stationary spraying outfit. With a lead of hose fitted with a spray gun this is a useful unit for spraying small orchards.

THE PEA CROP IN NEW ZEALAND

By J. P. BEGGS,
Instructor in Agriculture,
Rangiora.

THE New Zealand pea industry began in the nineties, and since then has progressed with marked fluctuations till, at the present time, the very attractive prices being offered are supplying an incentive to the wider growing of the crop. During the war, in response to urgent calls from overseas for peas for consumption and for sowing, the area grown annually showed a marked increase. In those years, too, the crop played a very important part in supplying local military requirements. Undoubtedly future developments will depend to a large extent upon the quality of the article offered to overseas buyers. As the pea crop is not covered by the certification scheme, it is very important that farmers and others do everything possible to prevent seed contamination through mechanical or other means.



[*Downie Stuart photo.*

Picking up peas from the windrow.

THE economic importance of peas in New Zealand depends upon the fact that they are used for both human and stock consumption, as well as being exported on a large scale. Both England and Australia are keen buyers of New Zealand peas.

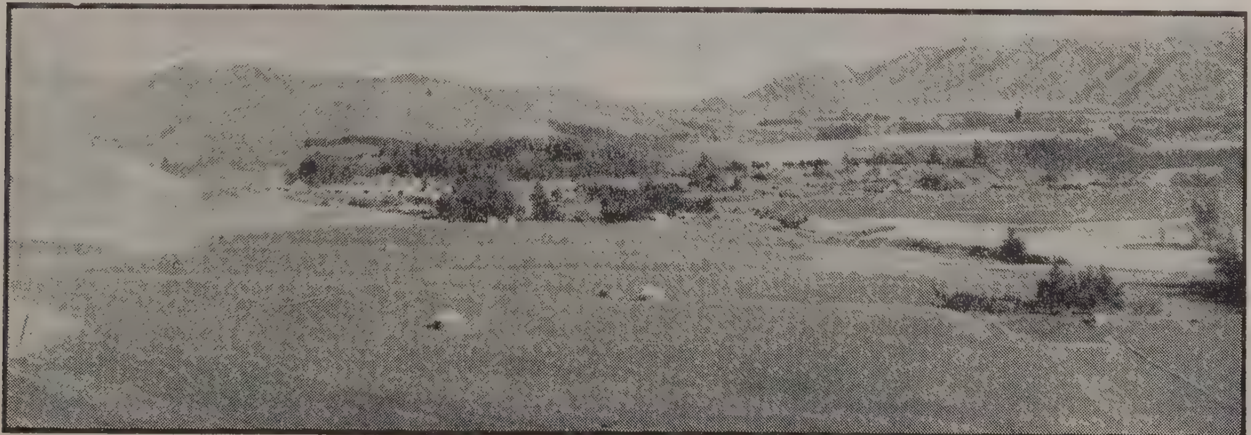
Before the war peas ranked as the fourth most important grain crop in regard to the area grown annually in the Dominion. Wheat, oats, and barley in that order were more important. During the war, however, peas replaced barley in order of importance. Over the ten-year period 1928-29 to 1937-38 an annual average of about 19,000 acres was grown at an annual value of approximately £145,000. In recent years, however, the large increase in the area grown and the high price paid per bushel have made the crop a much more valuable one to the country.

The annual area sown in peas has always been liable to wide fluctuation in response to overseas demand. The following table illustrates this point as well as showing the effect of the war on the growing of the crop:—

Year	Area Grown Acres	Yield per Acre Bushels
1934-35	25,000	17
1935-36	24,000	23
1936-37	18,000	27
1937-38	14,000	26
1938-39	13,000	29
1939-40	21,000	26
1940-41	35,000	21
1941-42	31,000	28
1942-43	33,000	27
1943-44	45,000	20
1944-45	44,000	24
1945-46	30,000	25

The above figures refer to peas for threshing only; both garden and field varieties are included.

Almost 90 per cent. of the total area of peas grown for threshing is located in the Canterbury and Marlborough



The Seddon district, Marlborough, an important pea-growing area.

districts, Canterbury itself accounting for 65 per cent. of the total area. On an acreage basis the average distribution for the main land districts during the past 8 years is as follows: Canterbury 65 per cent.; Marborough 24 per cent.; Otago 4 per cent.; Nelson 2 to 3 per cent; Wellington 2 to 3 per cent. Each of the other six land districts produces less than 1 per cent. of the total area.

In Marlborough, owing to the limited area of cultivated land available, pea growing is more concentrated than in any other district. Most of the garden seed peas for home garden use throughout New Zealand are grown in this district.

Description of Plant

Peas belong to the plant order *Leguminosae* and the species *Pisum sativum.* The botanical name for garden peas is *Pisum sativum hortense* and for field peas *Pisum sativum arvense.*

Peas, which are self pollinated and are thus not dependent on bees or other insects for the production of a good seed crop, are therefore not subject to contamination by cross fertilisation.

Varieties differ appreciably in the height to which plants grow. Under average conditions dwarf varieties may be only 18in. high, while the tallest varieties may reach a height of 5ft. Dwarf stature is usually associated with lower production.

Mature pea seed may be wrinkled, dimpled, or smooth in the seed coat. Examples of varieties exhibiting these conditions in the above order are Greenfeast (and most garden peas), Harrison's Glory, and Blue Prussian.

In common with other leguminous plants such as clovers, peas enrich the soil by increasing its nitrogen content, and it has been estimated that an average crop harvested for seed will add the equivalent of 1cwt. of nitrate of soda per acre to the soil.

Varieties and Classification

There are many varieties of peas listed in trade catalogues. This, of course, applies more particularly to garden peas. Varieties are listed as first early, second early, early main crop, main crop, late main crop, and late, and though the number in each section is a great joy to the keen amateur gardener, who must try them all, to the not so keen it is only a source of confusion.

Often one variety will have two or more names. Greenfeast, for example, is also known as Lincoln and Homesteader, and several other listed varieties are often found to be merely slightly varying strains of the one variety.

Following is a broad classification covering both garden and field peas, with the more common varieties listed in each group:—

A. Garden Peas

1. Early: William Massey, Peter Pan, Little Marvel, Blue Bantam.

2. Mid-season: Greenfeast, Onward, Greencrop.

3. Late: Stratagem, Lord Chancellor.

B. Field Peas

1. Blue peas (smooth blue or green seed, white flower): Blue Prussian, Mammoth Blue.

2. Marrowfat peas (dimpled blue or green seed, white flower): Harrison's Glory, Imperial Blue.

3. White peas (white seed, white flower): White Ivory, White Prolific.

4. Partridge or maple peas (dark seed, coloured flower): Partridge.

A recent survey of the acreage of the different types of peas grown in New Zealand for harvesting in a mature state disclosed the following proportions:—

	Per cent.
Garden peas (all varieties)	45
Prussian Blue	20
Mammoth Blue .. less than	1
Marrowfat (Harrison's Glory and Imperial Blue)	3
White peas (White Prolific and White Ivory) .. .. less than	1
Partridge	30

Garden varieties are grown on a field scale in New Zealand chiefly to produce seed stocks for resowing to produce the common green peas of the vegetable garden.

Field varieties, on the other hand, are usually utilised in the dry state, either as "boiling" peas (after soaking), for inclusion in soups (after splitting), or as stock food.

Only the more popular varieties of garden peas are listed in the above classification. Merchants are still contracting for various other varieties, which may be grown by the farmer under numbers instead of names. Often, too, firms in England send out lines of seed to New Zealand merchants to be grown for seed production, all the produce being returned for sowing in England. Many such varieties are not suited for New Zealand conditions, and are not grown as a market garden crop in this country. Varieties grown on contract to firms to a small extent are Laxton's Progress, Thomas Laxton, English Wonder, Witham Wonder, Alderman, and Senator. Other varieties which have been widely used in the past, but which are now losing favour, are Yorkshire Hero, or Greatcrop, Daisy, American Wonder, and William Hurst.

The main pea varieties are briefly:—

Garden Varieties

Greenfeast.—This is a hardy variety which yields well and has a wide adaptability. It deserves pride of place in the garden. The pods are curved and the peas dark green and of good quality. Its main weakness is that it is susceptible to mosaic disease, although this disease appears to be of importance only in the Marlborough district.

William Massey.—This is the chief early pea for local market garden use and for export. It forms an excellent combination with Greenfeast when sown at the same time, as it is ready to pick before Greenfeast. It has a wide range of adaptability to soil and climate, but requires higher fertility conditions than Greenfeast. This variety produces a fair crop of good-quality peas, and is resistant to pea mosaic disease. Endeavours are at present being made to develop by breeding a similar type with increased yielding ability.

Onward.—This variety, which is of comparatively recent origin, is becoming popular. It is a mid-season type showing good adaptability and producing good yields of large seed. The pods are large and puffy in appearance. This is a good variety for table use.

Stratagem.—A late-maturing variety which produces a dark-green pea of good quality. The pods are straight and the yield good. Though this is an ideal pea for culinary purposes, its use in recent years has greatly decreased.

Field Varieties

Harrison's Glory.—This is a marrowfat type and is a common packet pea used for boiling. The seed is blue and dimpled.

Blue Prussian.—Blue Prussian is another boiling variety which was fairly widely grown for military needs during the war. It has not been popular on the English market owing to its small size and varying degree of hardness.

Mammoth Blue.—Mammoth Blue is a smooth blue type which has recently been released by the Agronomy Division of the Department of Scientific and Industrial Research. It is a larger pea than Blue Prussian and gives heavier yields. When harvested under good conditions it produces a very attractive sample, but is inclined to weather more badly than Prussian Blue under adverse conditions.

White Ivory.—This is a splitting pea used for soups. It is not widely grown in New Zealand on account of its low yield. However, the good demand for this type of pea in England has led to the breeding of an improved variety (White Prolific) by the Agronomy Division.

Part of a good crop of Greenfeast peas being grown at Pukekohe for canning.

Partridge.—The flower of this pea is coloured and the seed itself has a coloured coat and yellow flesh. This has been the most widely grown variety of pea in New Zealand. It is used locally in the split pea trade, though it is not as good as the white pea for this purpose. It is typically a dimpled variety, but lines are preferred as nearly smooth as possible, as this facilitates polishing after splitting. In England these peas have been used mainly for pigeon feeding, but more recently a large portion is being used for human consumption.

Seed Selection

Most self-pollinated plants, such as wheat, normally reproduce fairly true to type, but variation from the true varietal type is common in all varieties of peas. A frequent digression from type is reversion to a tare-leaved, low-producing species of plant. Some varieties are more subject to this than others.

Owing to this instability of the variety, careful and continuous re-selection is necessary if varieties are to be maintained true to type and highly productive, so that a keen overseas demand for our produce is maintained.

Certain firms in New Zealand carry out selection work in garden varieties, but to maintain the highest possible standard in the more important varieties of peas the Agronomy Division has been working for many years on breeding and re-selection work. The more important varieties of garden peas, including Greenfeast, William Massey, Onward, Pioneer, and Little Marvel, are re-selected regularly and nucleus stocks built up from single-plant selections are produced annually for supply to mercantile firms engaged in garden pea seed production. These stocks are issued to farmers to grow under contract to the merchants, and the produce is used for the following season's main commercial sowings.

In addition, the Agronomy Division has bred several new varieties, including Greencrop, Mammoth Blue, White Prolific, and Mammoth White, which possess characteristics which entitle them to widespread trial. Greencrop is a garden variety which matures a little earlier than Greenfeast, Mammoth White is a large-seeded, white field variety, and the other two are referred to in the comments on varieties.

Utilisation of Pea Crop

The pea crop has a wide utility. Main production of the garden pea is in the market garden and the household garden; in the canning industry, which has increased rapidly in several districts during recent years, such varieties as William Massey, Greenfeast, and Canners Perfection are used; and there is also an impotrant export seed trade.

The even wider range of utility of field peas includes packet peas for boiling (Marrowfats, Blue Prussian), split peas for soups (White Ivory, Partridge), bird feed (Partridge for pigeons), and stock fodder.

As stock fodder the green crop is a palatable forage crop, but at present prices the peas are too valuable for the crop to be fed green. Sowing peas in combination with a cereal for the production of hay was common in the past, but has decreased greatly in recent years. The threshed straw, too, is a useful stock food if saved in good condition, and straw from canning peas makes good silage. Pea offals and undergrade peas are also used as pea meals or kibbled peas for feeding to cows, pigs, calves, and sheep.

A very substantial export trade exists for all types of peas for use either for resowing (in the case of garden varieties) or as a foodstuff (in the case of field varieties). Export figures for 1946 show quantities of the main types and chief importing countries as follows:—

		Field Varieties	
	Garden Varieties Tons	Blue Types Tons	Partridge Tons
United Kingdom ..	3,650	360	2,350
Australia	1,930	530	130
Eire	7	330	14
France	124	—	10
Belgium	15	200	30
South Africa ..	32	680	35
Hong Kong	—	2,330	—
Ceylon	—	105	—
Malaya	—	660	—
Other countries ..	12	65	1
Total exports ..	5,770	5,260	2,570

Soil Type and Climate

The pea crop is a risky one because its success depends on suitable soil and climatic conditions. Extremes of wetness or dryness may cause a complete failure, and humid conditions may result in heavy growth of foliage and a poor yield of seed, particularly with the Partridge variety, which as a result is usually grown on lighter land.

Conditions are ideal for peas when the atmosphere is mild and reasonably dry and the soil moist. Frosts do not injure the crop except at the flowering period, when the setting of seed may be seriously affected. Hot, dry northwest winds in Canterbury during the flowering period can seriously reduce the yield; moist conditions to stimulate flowering are beneficial at this time.

The ideal soil is a sweet, friable, and well-drained loam with a high humus content. Heavy, clay soils are unsuitable, but success can attend sowings on fairly light land if rainfall conditions are suitable. Very rich soil like that in holding paddocks encourages the formation of much foliage and little seed.

As the period during which weed control can be carried out during the growth of the crop is short, another important consideration is relative freedom of the soil from weeds. Many paddocks have become in a very bad state with weeds such as Californian thistle, largely through too much pea growing.

Garden peas are more susceptible to adverse conditions than field peas; many garden varieties are suited only to localised conditions, though others, like Greenfeast, have a wide adaptability.

Place in Rotation

The pea crop can be very valuable in the cropping rotation, but its use can be overdone. If it is used suitably in the rotation, much of the uncertainty about the crop is removed.

Without a doubt peas do best after grass. At this stage the soil is rich in humus, and accordingly in moisture-retaining properties. This is an important point if continued dry conditions are experienced during the growing period of the crop. It is important too if wet conditions are experienced shortly after sowing, as a humus-rich soil does not run together and cake as badly as a cropped-out one. Serious weed competition is also less likely to be encountered after pasture than after crop.

The natural crop to follow peas is a cereal. The cultivation required for wheat after peas is a simple and inexpensive operation.

Preparatory Cultivation

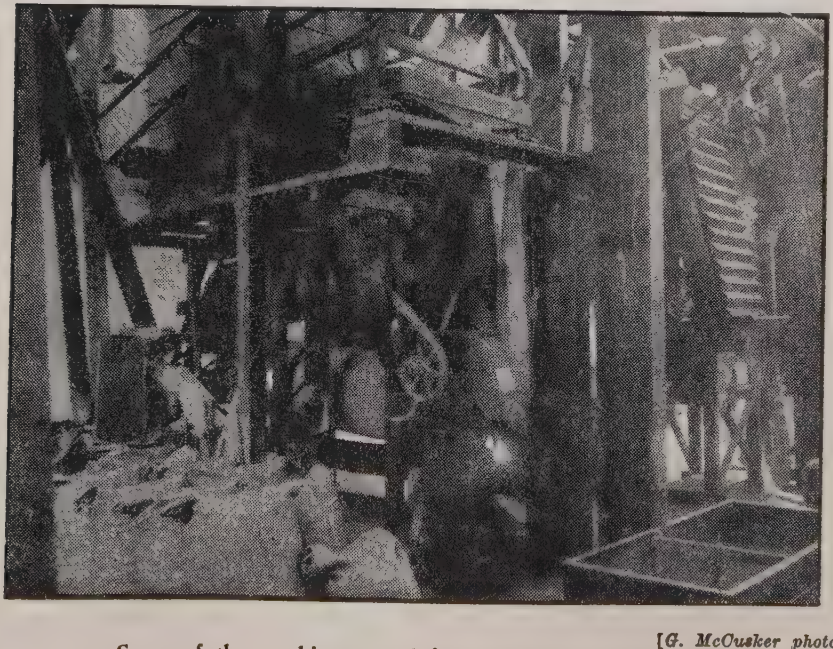
Preparatory cultivation for peas should commence early. After pasture, skim ploughing or grubbing should be carried out in the early autumn and deep ploughing should follow early enough to allow ample time for the frost to work the soil during the winter. The amount of spring cultivation necessary for the preparation of the seed-bed is greatly reduced if ample time has been given for the natural weathering of the soil.

As turf brought to the surface after deep ploughing is a handicap during harvesting operations, discs are sometimes used in preference to the grubber for surface working. The final seed-bed should have a good tilth underneath, but the surface should not be too fine. A rubbly condition is desirable on top. The use of the roller cannot be recommended either immediately before or immediately after drilling.

In paddocks which have been seriously attacked by grass-grub skim ploughing in the autumn may not be necessary.

Manurial Treatment

In common with other leguminous crops such as lucerne and clovers, peas thrive on sweet land. Following recently-limed pasture no further addition of lime is necessary at time of sowing, but if lime is likely to be deficient in the soil, it is desirable to drill 2cwt. per acre of carbonate of lime with the seed. Where the lime deficiency is known to be high an application of 1 ton of carbonate of lime per acre, made following deep ploughing and well ahead of drilling, will be beneficial. In addition superphosphate or reverted superphosphate should be drilled with the seed at the rate of 1cwt. to 1½cwt. per acre. The use of nitrogenous fertilisers is not recommended.



[G. McCusker photo.

Some of the machinery used for cleaning peas for seed.

Seed Treatment

Although not universally adopted, the dusting of the seed with mercuric or copper preparations is a very wise precaution. When sown too early, and when wet conditions follow sowing, peas, especially garden varieties, are very susceptible to pre-emergence attack by fungus. Seed treatment greatly reduces this type of damage, besides giving a partial control of the collar rot disease.

Sowing

Spring climatic conditions often control the time of sowing, but October is the main seeding month for commercial sowings in Canterbury. Early sowing, either in late September or early October, is preferable if the soil is warm enough. Peas do not thrive if sown late when conditions are dry and hot. November sowings are necessarily confined to heavy land. September sowings are more common in Marlborough than in Canterbury.

Early sowing is most important with late-maturing varieties such as Partridge. As this variety is normally sown on lighter land than garden peas, it is possible to sow it earlier. In Marlborough field peas are sometimes sown as early as May, and in Canterbury some autumn sowing is also carried out, but this practice is not common.

Sowing at a depth of 2in. through every coulter of the grain drill is the method most commonly adopted by the commercial grower. Seeding rate is usually 3 bushels to 3½ bushels per acre. The size of seed is variable and the seeding rate should be adjusted accordingly. With some of the larger-seeded varieties up to 5 bushels per acre are sown. One common and successful method of sowing is to cross-drill at the rate of 2 bushels per acre each way.

There is a considerable risk of damaging seed when the force-feed drill is used, and germination capacity is liable to be reduced. The spoon-feed drill has always been favoured for the sowing of peas, especially large-seeded varieties. A special pea feed for the grain drill has recently been patented and has proved highly satisfactory. It is a wise precaution to test the drill before going out to sow large-seeded varieties, as even bruising of the seed without any actual cracking may reduce germination.

Finely-powdered graphite mixed with the seed at the rate of 2oz. per bushel helps to reduce damage to the seed in drilling.

Subsequent Cultivation

As cultivation for weed control in pea crops is possible only before the formation of tendrils, it is important to do everything possible to destroy weed growth early, and harrowing should be carried out both before and after the crop appears above ground level. One or two pre-emergence harrowings may be carried out, but care must be taken not to do this work when there is any likelihood of damaging the young shoots. After the young plants are about 2in. high two or three further harrowings may be carried out. Rolling following the final cultivation may be done if necessary to render the ground suitable for harvesting operations.

In all this cultivation work the lightest tractor available and one with pneumatic tyres should be used. Further, the work should be carried out at low speed.

Rogueing

Pea varieties are very susceptible to the development of "off-types" and admixture of foreign varieties by mechanical means is also a frequent source of contamination. To maintain the high standard of purity required by export and local markets, merchants commonly employ gangs of trained men to go through their contract crops and remove these off-types and rogues. Special care is taken in the rogueing of the "stock" areas, and to facilitate this operation such crops are usually sown in 21in. rows.

Harvesting and Dressing

The time from sowing to seed harvest differs widely with variety, and soil and climatic conditions also have a marked influence, but the following figures may serve as a general guide to forecasting harvest dates:—

Greenfeast, under reasonably early conditions in Canterbury, can reach maturity in 19 to 20 weeks. In trials at Palmerston North maturity was reached in 17 weeks.

William Massey would be two or three weeks earlier than Greenfeast. Partridge and Blue Prussian reached maturity at Palmerston North in 18 to 19 weeks. In Canterbury this period would be extended to 21 weeks for fairly early conditions.

The above figures refer to the period from sowing to the ideal time for cutting peas for threshing and not to the stage of being ripe for heading.

Good colour, especially in garden peas, is desirable, and if seed is to be harvested in this condition, the crop should be cut when the top pods are just past their best for table use. When the crop is cut at this stage, however, it is necessary to leave it to mature for a week or longer before threshing. This introduces an element of risk, especially from wind, which not many farmers are now prepared to take. The common practice, therefore, is to allow the crop to become header ripe, when it is cut with the mower directly in front of the header harvester. Such attachments as pea lifters and a "gooseneck" may be fitted if conditions warrant it. Pea rollers have lost favour in Canterbury, as their use increases the risk from wind.

The threshing of a crop in good condition is a relatively simple matter if the header is efficiently handled. The first essential is a relatively fast drum speed, with the concave set fairly wide so that damage to the seed is reduced to a minimum.

Field peas, such as Partridge and Blue Prussian, are usually direct headed. To allow for conditioning of the seed following threshing, sacks should either be left in the paddock for a few days or placed on the grating of the woolshed.

Machine dressing is necessary with garden varieties and those used for boiling. Garden peas are also sometimes hand picked while travelling on a slowly-moving belt. This operation is expensive, but it permits the removal of shrivelled, discoloured, and foreign seeds. Partridge peas are not usually machine dressed.

Yield

As figures earlier in this article showed, the yield of peas is subject to wide fluctuations. In the 12-year period for which the figures were given the Dominion average for all threshed peas varied between 17 bushels and 29 bushels an acre. The highest average since the 1927-28 season was 30 bushels an acre. The average yield for each of the Canterbury and Marlborough districts for the last eight years is 26 bushels an acre. The Dominion average for the past 12 years is 24 bushels an acre. The official bushel weight for peas is 60lb.

Marketing

Peas are usually grown on contract to a mercantile firm, the merchant arranging contracts in accordance with overseas demands. The merchant buys from the farmer on a field-dressed basis, and arranges for marketing either overseas or locally. England is the chief market for New Zealand peas, although Australia is also a large buyer. The more consistent overseas demand in recent years, however, has led to an increase in the growing of "free" peas. This has been more particularly the case with field peas such as Partridge and Blue Prussian, although garden varieties are also concerned.

The Canterbury Chamber of Commerce makes up standards each year for both Partridge and Blue peas and forwards them to the London Corn Trade Association for approval and adoption as a basis of trade between New Zealand sellers and overseas buyers. Two grades are adopted for each type—described as "No. 1" and "f.a.q."—other lines being sold as under grade.

Diseases

Several diseases to which the pea crop is subject are as follows:—

Damping off.—This disease is brought about by various fungi in the soil which cause the rotting of the seedling. It is a serious disease in some seasons when wet conditions are experienced immediately after sowing. Seed treatment as discussed earlier in the article gives a fair measure of control.

Collar rot.—Collar rot, also a common disease, is caused by a fungus and, like damping off, is most prevalent in wet seasons. Brown to dark purple lesions are formed on the stems and spots appear on the leaves. The lesions on the stems occur particularly about ground level. Infected plants become severely stunted and may die off.

The disease is both seed and soil borne. Some control is secured by seed treatment, but on infected land crop rotation is necessary.

Infected seeds are usually slightly discoloured, and much infection may therefore be avoided by the hand picking of seed.

Mildews.—Two types of mildew affecting peas are both caused by fungi. Under South Island conditions they are not important diseases, but they may cause some trouble in market gardens in the North Island. Spraying gives effective control.

Mosaic.—Mosaic is an important disease only in Marlborough. It is caused by a virus and the only method of control is by the use of resistant varieties such as William Massey and Onward. Greenfeast is unfortunately susceptible.

The prevalence of mosaic in Marlborough is due to the wide use of red clover, on which the virus overwinters in that district.

Acknowledgment

For his valuable assistance in supplying the varietal classification and other details in this article, acknowledgment is made to the Director of the Agronomy Division, Department of Scientific and Industrial Research, Lincoln.

★

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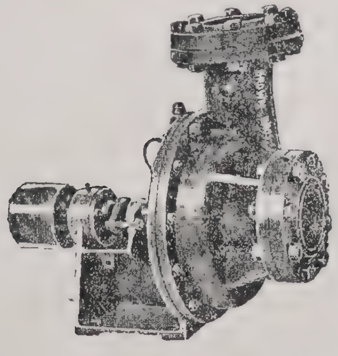

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FARMING IN NEW ZEALAND

Intensive Grassland Farming

By P. W. SMALLFIELD, *Director, Rural Development Division.*

THE previous articles in this series traced the development of New Zealand farming up to 1920; this article covers the progress made during the next 25 years and shows how the wider use of intensive grassland farming practices has enabled the Dominion to increase the production of its pastoral industries without any great enlargement of the area under grass. The next section, to appear in the March issue, will deal with annual crop production and the meat industry from 1920 to 1945.

NEW ZEALAND farming made remarkable technical progress between 1920 and 1945, though the real importance of that progress has been overshadowed to a certain extent by wars and their consequent economic crises. For the period began in the shadow of falling prices and inflated land values after the First World War, was subject to the economic blizzard of the thirties, and ends in the shadow of a hungry world after the Second World War.

Important as were the marketing and relief measures caused by the wars and economic crises, it is felt that the period will be remembered in farming history essentially as one when farmers first felt confident to exploit the full powers of fertilisers, lime, and selected strains of grasses and clovers in pasture development. Those were the tools which were used with confidence not only on the more fertile lands but also on much inferior ploughable land in the high-rainfall areas. By, as it were, building a veneer of fertility on these scrub land heaths the apparent paradox was created of pastures growing high-class milk-producing fodder being established on apparently- unchanged and naturally-sterile soil.

The essential feature in pasture production was the development of higher carrying capacity mainly through the use of fertilisers and lime. Though the sown grasslands increased by only 1,500,000 acres, there was an increase of 1,000,000 dairy cows in milk and 7,000,000 in the number of sheep shorn, as shown in Table I.

TABLE I—AREA UNDER PASTURE AND CONSUMED CROPS AND NUMBERS OF LIVESTOCK, 1920 and 1945

Pastures and Crops	1920	1945
	(millions of acres)	
Sown grass	16	17.5
Annual crops	1	1
Native grass and tussock	15	14
Livestock	(millions)	
Cows in milk	.75	1.75
Total cattle	3	4
Sheep shorn	23	30

The enlarged pasture area was mainly the result of the sowing down of scrub land in the North Island and tussock land in the South Island. More grass was sown on virgin land than this 1,500,000 acres, for fairly large areas of marginal grazing land (probably 750,000 acres) subject to reversion and deterioration went out of occupation.

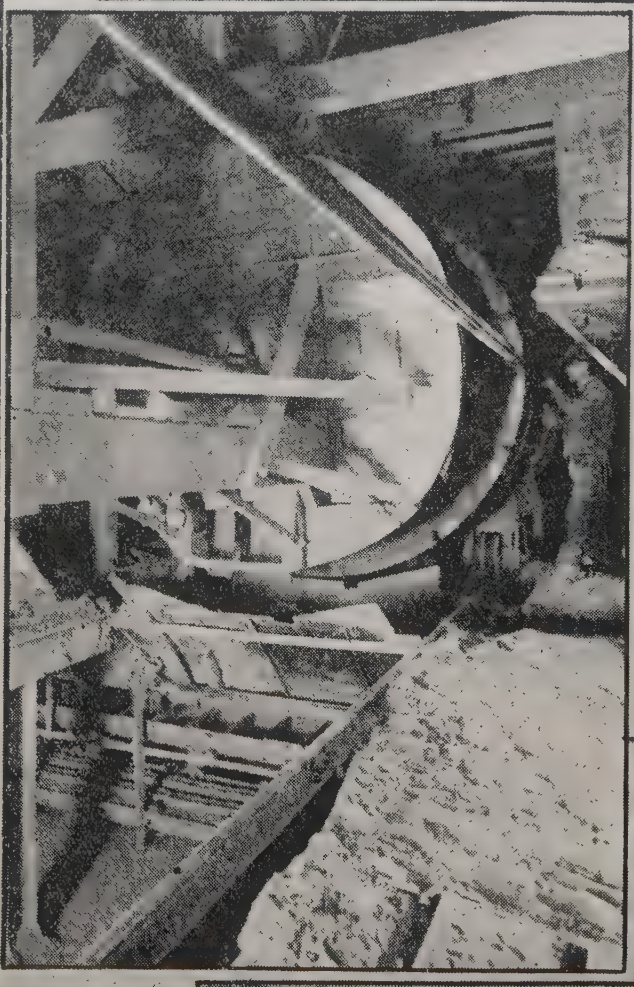
The increase in carrying capacity was by no means uniform over the Dominion and was restricted to areas where topdressing became a regular practice. For instance, in the Waikato 10 acres of grassland in 1925 carried two cows in milk and one breeding ewe; in 1945 four cows in milk and six ewes were carried on the same area.

Topdressing

Topdressing had received a severe setback during the First World War because of restricted fertiliser importations. After the acquisition of abundant supplies of rock phosphate from Nauru and the erection of superphosphate works supplies of fertilisers again became freely available, and with the development of dairying and improved road and rail transport fertiliser and lime usage increased and spread to districts where the farmers had previously not considered topdressing necessary or where lack of transport had precluded its use.

In those districts the development of topdressing was greatly stimulated by the demonstration plots laid down by the Fields Division of the Department of Agriculture. Farmers who had never used fertilisers before for their pasture lands were brought together for field day meetings on demonstration plots and could then see for themselves the pasture sward improvement which phosphatic fertilisers and lime brought about. What they saw were originally inferior swards of cocksfoot, Yorkshire fog, sweet vernal, browntop, rib grass, and catsear changed completely by the growth of white clover and consequent stimulation of stunted plants of perennial ryegrass. Generally the changes in sward composition were so marked on pasture land sown down after being ploughed that only these simple observational plots were necessary to

SUPERPHOSPHATE



The increased use of superphosphate was one of the important features of farming during the 1921-1945 period. These illustrations depict the original cantilever phosphate rock loading equipment at Nauru Island; the first stage in the manufacture of superphosphate, showing the den during the shredding of the superphosphate, made by treating crushed phosphate rock with sulphuric acid; and the application of superphosphate to the land, illustrating how farmers used phosphates, together with lime and Certified grass seed, to build better pastures and thus increase by 9,000,000 breeding ewes and 1,000,000 dairy cows the flocks and herds depastured on the grasslands of New Zealand.

[Centre and lower photographs by Sparrow Industrial Pictures Ltd.

stimulate the expansion of topdressing in the higher-rainfall areas.

The importation of high-grade phosphate rock from Nauru and the consequent development of superphosphate manufacture caused superphosphate to become the common topdressing fertiliser, but on many soils it required the addition of lime to give the best results. Slag, however, continued to be an important topdressing fertiliser, and more than 90,000 tons were brought in in 1928, 1929, and 1937. Table II gives details of the fertiliser usage between 1926 and 1945. Usage declined during the depression years in the early 1930's but recovered after 1936. Maximum usage was recorded for the 1940-41 season, to be followed by another decline during the later war years when rationing had to be imposed to secure a fair distribution of the smaller supplies available.

In addition to phosphates, lime became an increasingly-important material for topdressing. Lime delivered by the railways increased from 91,506 tons in 1924 to 725,386 tons in 1945. Imports of potassic and nitrogenous fertilisers showed considerable fluctuations. The figures for potassic fertilisers rose from about 1500 tons in 1921 to more than 12,000 tons in 1928, declined during the depression years of the early 1930's, but rose again and reached more than 18,000 tons in 1939, only to decline again as supplies were cut off during the Second World War. Nitrogenous fertilisers, particularly sulphate of ammonia, gained a certain measure of attention for topdressing during 1928 and 1929, when more than 8000 tons were imported in each year, but farmers soon found that the brief stimulus given to pasture growth by nitrogenous fertilisers did not give an adequate return for the cost.

Statistics on the area of grassland topdressed are available since 1929 and are set out in Table III.

TABLE III—GRASSLAND TOPDRESSED

Year ended January 31	Artificial fertiliser only	Lime only	Both fertiliser and lime	Total area topdressed
	Acres	Acres	Acres	Acres
1929	2,531,530	223,373	2,966	2,757,869
1930	2,854,657	359,663	*	3,214,320
1931	2,432,438	438,878	*	2,871,316
1932	2,067,672	386,649	*	2,454,321
1933	1,741,035	102,952	594,127	2,438,114
1934	1,469,537	116,234	663,399	2,249,170
1935	1,703,325	145,986	834,803	2,684,114
1936	1,798,714	150,925	932,585	2,882,224
1937	2,122,386	176,763	1,027,130	3,326,279
1938	2,516,236	188,953	1,168,800	3,873,989
1939	2,584,618	218,445	1,213,881	4,016,944
1940	2,764,295	204,478	1,218,511	4,187,284
1941	2,923,378	250,972	1,474,967	4,649,317
1942	2,324,136	380,145	1,508,096	4,212,377
1943	1,574,786	570,847	1,324,422	3,470,055
1944	1,471,067	729,683	1,169,215	3,369,965
1945	1,602,887	726,467	1,317,037	3,646,391
1946	1,757,762	606,744	1,288,743	3,653,249

* Not quoted for these years.

Apart from the progressive increase in the area topdressed up to 1941, the most interesting feature has been the expansion in the use of lime, for the table shows that in 1929 only about one-tenth of the pastures topdressed received lime, whereas more than half did so in 1946. In the North Island topdressing with phosphatic fertilisers usually preceded rather than succeeded topdressing with lime. Superphosphate was the common fertiliser used on soils not very responsive to lime, and basic slag and rock phosphates on soils which were lime responsive. The receipts secured from the increased carrying capacity of the topdressed grassland were then invested in the establishment of new pastures sown after areas of inferior grass had been ploughed up and in the application of lime and, in certain restricted areas, of potash. In the South Island, however, following Southland practice, lime usage usually preceded fertiliser usage on grassland, the reason for the difference in practice being that North Island topdressing spread from the Waikato, where the soils are not particularly lime responsive, whereas the opposite was the case in Southland, which led South Island topdressing practice.

TABLE II—FERTILISER USAGE

Season	Superphosphate (straight)	Other phosphates	Blood and bone, blood, bone, etc.	Potashes, sulphate of ammonia, nitrate of soda	Total
	Tons	Tons	Tons	Tons	Tons
1926-27	187,761	71,814	*19,768	12,648	291,991
1927-28	295,919	66,487	*21,331	8,009	391,746
1928-29	275,488	151,249	*24,746	13,701	465,184
1929-30	299,327	183,555	24,031	18,992	525,905
1930-31	234,220	125,266	25,340	17,814	402,640
1931-32	231,078	97,021	22,556	9,157	359,812
1932-33	307,224	59,480	26,115	10,513	403,332
1933-34	280,418	64,266	24,001	7,490	376,175
1934-35	313,924	25,305	23,021	11,178	373,428
1935-36	331,029	54,895	25,234	15,242	426,400
1936-37	370,178	92,337	25,338	15,027	502,880
1937-38	447,407	120,862	21,676	21,371	611,316
1938-39	461,572	107,291	23,535	21,990	614,388
1939-40	511,570	111,896	26,684	22,461	672,611
1940-41	598,529	58,534	29,846	11,748	698,657
1941-42	418,562	47,563	32,221	4,085	502,431
1942-43	294,935	27,374	34,828	5,194	362,331
1943-44	250,894	128	29,512	4,882	285,416
1944-45	364,928	29,619	*29,000	6,339	429,886

* Estimate

The second phase of resowing pastures on ploughable land followed closely the inauguration of the seed certification scheme of the Department of Agriculture, for with Certified seeds the farmer was fairly sure that the new pasture he sowed down would be superior to the old pasture he broke up.

Finally topdressing was extended to surface-sown hill country and, accompanied by the introduction of subterranean clover into danthonia swards, was instrumental in raising the carrying capacity of considerable areas of pastoral lands. It is this phase of topdressing which awaits full exploitation in the future.

Certified Seeds

In 1920 the average North Island farmer was very diffident about ploughing up and resowing inferior grassland. Perennial ryegrass seed, which must always form the basis of mixtures for ploughable land, came very largely from the short-rotation pastures of Canterbury, which at that time consisted very largely of false perennial ryegrass lasting sometimes one, usually two, or possibly three years. Though there was a very general idea that seed from old-established pastures was more permanent than seed from the short-rotation pastures of the arable areas, the seed of commerce was very mixed and farmers found great difficulty and no guarantee of success in their search for seed of truly perennial strains.

In the autumn of 1928 E. B. Levy, then Agrostologist, Department of Agriculture, sowed down a large number of pasture plots on a number of soil types to determine whether by the use of lime and fertilisers all the better soil types could be "conditioned to the perennial ryegrass-white clover standard" and what place strain of seed might play in extending the use and permanence of these species. After a year's growth the plots showed quite definitely that strain in ryegrass was an all-important factor. Levy and Davies, reporting on these trials, stated:—

"The true perennial has made good headway and has increased markedly at the end of 12 months, whereas the pseudo-perennial (the Southland type) has decreased by more than half, and the annual and pseudo-perennial Canterbury type has virtually disappeared from the pasture. Each of these areas was laid down with 4cwt. of carbonate of lime and 3cwt. of superphosphate at time of sowing and during the following winter was topdressed with 3cwt. of superphosphate or slag plus

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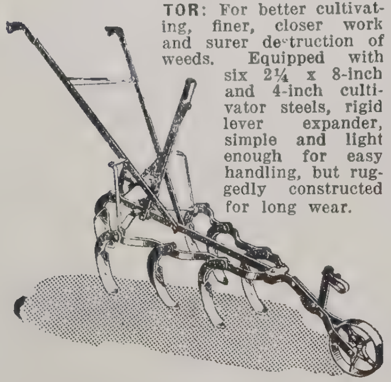

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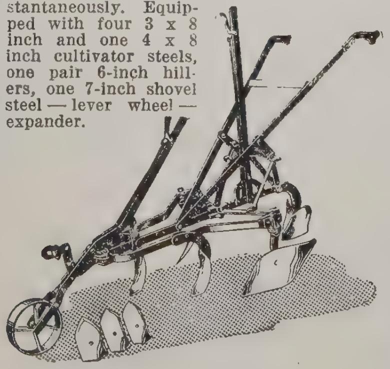

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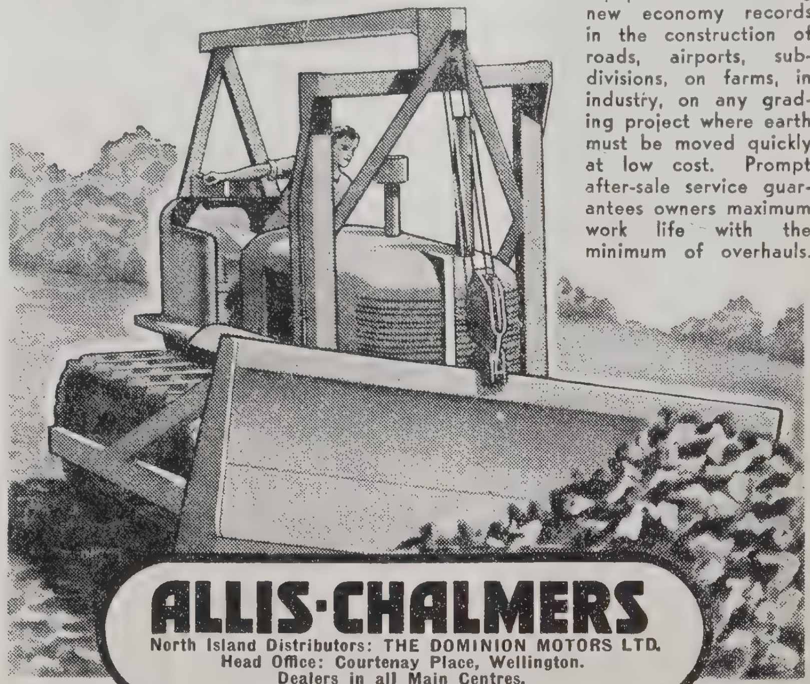

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"The knowledge that this failure can be to a large extent avoided, and that if a genuine perennial be sown there will persist a ryegrass that will respond to manuring and pay handsomely from the time of renewal, will be far reaching. The writers venture to suggest that just as soon as we can get back to the market genuine perennial ryegrass at a reasonable price, there will be a revival of the plough and subsequent manuring of a turf that is worth while.

"New Zealand is extremely fortunate that she has at hand a good perennial ryegrass type, probably equal to any commercial strain throughout the world—the Hawke's Bay type. Not all seed from this source is genuine perennial, but at comparatively-small expense the genuine crops may be identified, and, with these as a nucleus, mother seed can be produced; this once grown will soon furnish a sufficiency of the genuine article for all of New Zealand's requirements at least. This is the urgent problem, but it must be followed up by detailed work to isolate 'super' strains, as it were, from the general mass of Hawke's Bay and other true perennial ryegrass types."

The appropriate step of initiating a certification scheme for perennial ryegrass was immediately undertaken by the Department of Agriculture on similar lines to the scheme it then had in operation for potatoes, and subsequently the scheme was widened to cover other grass and clover seeds. Certified seed guaranteed the strain and, after demonstrations by widespread field plots of the truly perennial strains, farmers soon realised that Certified seeds would enable them to renew inferior grasslands with confidence.

[*National Publicity Studios photo.*

A Waikato dairy farm. The increase of about a million in the number of dairy cows in the Dominion between 1920 and 1945 was due chiefly to the application of intensive grassland practices on flat and undulating land already partially improved, rather than to the development of new land.

Intensive Grassland Farming

Pasture lands may be very broadly divided into two types: Pastures in which clovers or allied legumes are an important constituent, and pastures in which clovers are absent or occur to only a very minor degree. The former are characterised by a very much greater production of fattening and milk-producing herbage than the latter, and the term "intensive" grassland farming may be used for the exploitation of the former and "extensive" for the latter. Though those terms cover the broad division between a high concentration of stock and meat and milk production on the one hand and a lower concentration of stock and the production of store animals on the other, there are naturally many stages between the extremes.

However, the fundamental place that clover plays in the practice of intensive grassland farming should not be overlooked, nor should rotational grazing be claimed as the chief factor in meat and milk production on the intensive grassland farming areas of the Dominion.

The development of topdressing with phosphates or phosphates and lime was the initial step in the building up of intensive grassland farming, for it gave the necessary stimulus to clover, which in turn stimulated grass growth—particularly the growth of perennial ryegrass. With the production of more abundant and nutritious herbage more livestock could be carried, and more livestock meant more animal manure dropped on the fields, with consequent further benefit to grass growth. This combination of fertilisers, lime, livestock, and perennial strains of grasses and clovers gradually built up fertility and production so that both the quantity and feeding value of the herbage were improved.

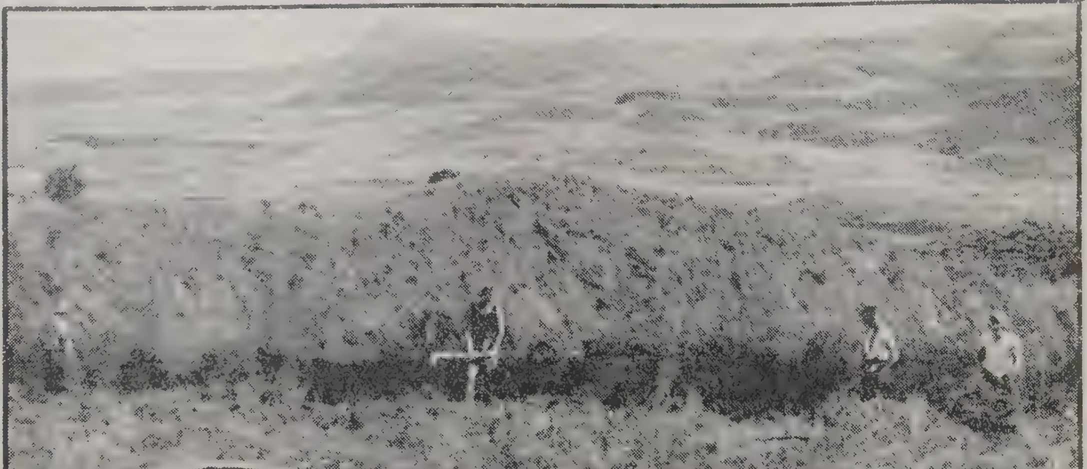
Accordingly, during the 1920-45 period the density of livestock shifted toward districts where fertilisers and lime were used. That is demonstrated by the North Island breeding ewe numbers between 1925 and 1945, which are set out in Table IV.

During that period North Island breeding ewes increased by nearly 4,500 000 and the additional ewes were grazed mainly in the districts where intensive grassland farming was developed. That occurred on the alluvial flats and rolling downs of Northland, South Auckland, and the Waikato, on the newly-developed pumice lands on the Central Plateau and the Western Uplands, and on the alluvial plains and rolling downs of Rangitikei, Manawatu, and Hawke's Bay. On the other hand, ewe numbers declined or increased only very slightly in the areas where surface-sown hill-country pastures formed the chief sheep-grazing areas, as in the east coast and Castlepoint districts.

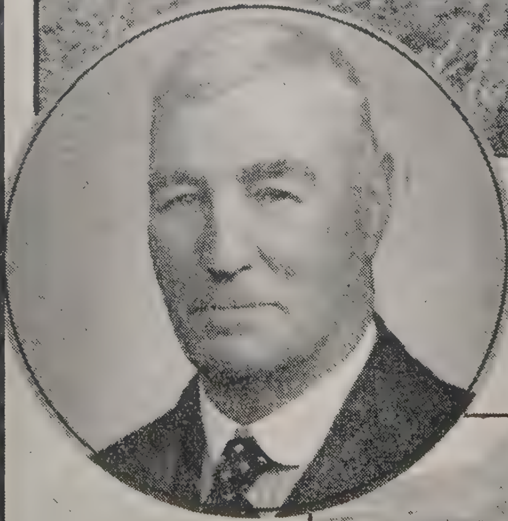
The rise in the numbers of dairy cows in milk between 1925 and 1945 is set out by districts in Table V. Here again the main increases occur in the areas devoted to intensive grassland farming in Northland, South Auckland, Waikato, Central Plateau, and Taranaki.

The increased productivity of the pastures brought about certain

GRASSING OF SCRUB LAND



Views of development work on Ngakuru Block, Rotorua, carried out by the Department of Agriculture. By, as it were, building a veneer of fertility on these scrub land heaths the apparent paradox was created of pastures giving high-class milk-producing fodder being established on an apparently-unchanged and naturally-sterile soil



The Rt. Hon. G. W. Forbes, Minister of Lands and Agriculture from 1928 to 1930, who instituted the large-scale development of scrub lands by the State under the authority of the Land Laws Amendment Act passed in 1929.

[Inset photograph by S. P. Andrew Ltd.

changes in management methods: Closer subdivision and consequent drinking water reticulation were provided; the development of perennial ryegrass-white clover-dominant pastures lessened the need for the production of annual crops for supplementary feeding, and hay and silage made from permanent grass became the chief supplementary feeds in the North Island intensive grassland farming districts. Closer subdivision gave more flexibility in grazing and allowed fields to be shut up in the autumn so that feed could be carried over into the winter and early spring. Thus grew up the methods of intensive grassland farming which have made possible the spectacular rises in livestock numbers, particularly in the higher-rainfall districts where the grasslands have been sown down after ploughing.

However, these developments were not confined to the North Island or entirely to pastures sown after ploughing. Southland showed the development of similar practices and rises in livestock numbers. Further considerable advances were made in the improvement of surface-sown pastures in Hawke's Bay through the introduction of subterranean clover accompanied by light topdressing.

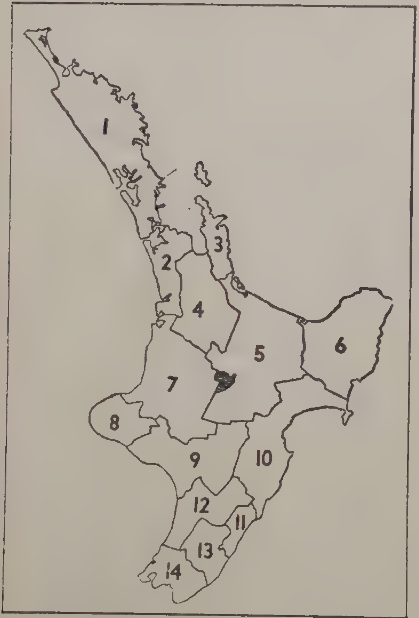


Fig. 1—North Island, showing district groups of counties. 1. Northland. 2. South Auckland. 3. Cape Colville. 4. Waikato. 5. Central Plateau. 6. East Coast. 7. Western Uplands. 8. Taranaki. 9. Rangitikei. 10. Hawke's Bay. 11. Castlepoint. 12. Manawatu. 13. Wairarapa. 14. Featherston.

Development of Scrub Land

The grassing of manuka scrub lands was greatly simplified by the introduction of Certified perennial ryegrass seed and the development of manurial and cultivation practices which ensured a good white clover growth from the time of initial pasture establishment. Previously scrub land development had been a slow process. The land was usually sown first in a temporary pasture, followed by other pastures of only moderate productivity, until the slow process of pasture and stock gradually raised the soil's fertility so that a satisfactory pasture could be obtained or the land was simply sown out with low-fertility-demanding grasses such as danthonia, chewings fescue, or ratstail, providing pastures of low production and feeding value. In the early 1920's even those methods came to a standstill, as the resulting pastures were not sufficiently productive to warrant the expense of development. Though fertilisers and lime were more freely available, their use was not warranted until the introduction of Certified seed made it reasonably certain that the perennial ryegrass sown would remain permanent and thus enable the expenses incurred in cultivation and fertilisers to be recouped. The sowing of pastures with false perennial ryegrass as the basis of the mixture was a sheer waste of money on poor land, for even under heavy manuring the ryegrass disappeared in one or two years.

TABLE IV—NORTH ISLAND BREEDING EWE NUMBERS BY DISTRICTS, 1925-1945

*District	Breeding ewes (000 omitted) 1925	1945	Increase or decrease Actual (000 omitted)	Per cent.
Northland	364	585	+ 221	+ 61
South Auckland	180	571	+ 391	+217
Cape Colville	33	66	+ 33	+100
Waikato	118	909	+ 791	+670
Central Plateau	76	291	+ 215	+283
Western Uplands ..	510	1,009	+ 499	+ 98
East Coast	1,326	1,253	— 73	— 6
Taranaki	126	331	+ 205	+162
Rangitikei	1,229	1,955	+ 726	+ 59
Manawatu	625	1,132	+ 507	+ 81
Hawke's Bay	1,667	2,395	+ 728	+ 44
Castlepoint	295	297	+ 2	+ 1
Wairarapa	547	649	+ 102	+ 19
Featherston	367	444	+ 77	+ 21
†North Island	7,464	11,890	+4,426	+ 59

* See Fig. 1 showing district groups of counties.
† Includes Eden, which is not included in any district total.

In the early 1920's Patterson and Dibble were able to demonstrate on the gum land heaths at Puwerá, North Auckland, that if a suitable strain of Hawke's Bay ryegrass was sown on land suitably cultivated, fertilised, and limed, a highly-productive pasture could be established and maintained on those naturally-infertile soils. However, they believed that considerable preparatory work to build soil fertility was necessary before sowing the land to permanent grass. Such work entailed subsoiling, green manuring, and draining, which naturally raised the cost of development.

No very great progress in scrub land development took place until 1930, when Certified perennial ryegrass seed became available and the State interested itself in land development. The technique necessary for the establishment of high-class pastures at the first ploughing was worked out on the large State projects, and details of the practices are well exemplified in the work carried out in the development of the pumice lands of the Central Plateau area.

Development of Pumice Lands

The pumice lands are on the Central Plateau which forms the main watershed of the North Island. Beginning south of Lake Taupo, it stretches

TABLE V—NUMBERS OF DAIRY COWS IN MILK IN THE NORTH ISLAND BY DISTRICTS, 1925-1945

*District	†Cows in milk at January 31 1925	1945	Increase or decrease Actual	Per cent.
Northland	116,629	256,931	+140,302	+120
South Auckland	75,421	139,615	+ 64,194	+ 85
Cape Colville	17,764	38,287	+ 20,523	+116
Waikato	204,544	383,796	+179,252	+ 88
Central Plateau	44,016	115,013	+ 70,997	+161
Western Uplands ..	46,008	41,152	— 4,856	— 11
East Coast	23,547	43,020	+ 19,473	+ 83
Taranaki	153,859	202,376	+ 48,517	+ 32
Rangitikei	62,643	52,604	— 10,039	— 16
Manawatu	104,525	125,573	+ 21,048	+ 20
Hawke's Bay	26,699	25,091	— 1,608	— 6
Castlepoint	1,460	1,189	— 271	— 19
Wairarapa	24,075	27,556	+ 3,481	+ 14
Featherston	21,653	25,163	+ 3,510	+ 16
North Island	922,843	1,477,366	+554,523	+ 60

* See Fig. 1 showing district groups of counties.
† Excluding boroughs.

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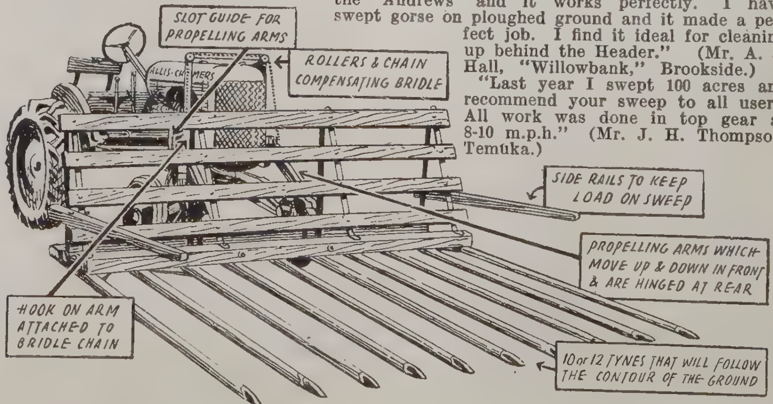
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ESTABLISHMENT OF PERMANENT GRASS

across the North Island from the main mountain range on the east to the high marine plain in the west and extends northward as far as the Bay of Plenty. Relatively flat over wide areas, the plateau rises here and there into high volcanic cones, flat-topped hills, and serrated ridges.

The soils of the pumice area are sandy and in an unimproved state appear particularly barren and unattractive. The undeveloped land is covered in a tangled mass of manuka and manoao, with tussock on the colder flats, and probably no better description of the difficulties of pumice land development can be given than the following extract from the evidence of Mr. J. B. Campbell before the Rotorua-Taupo Railway Parliamentary Committee in 1929:—

"The land will do nothing itself. It differs from other land in that it is only the medium by which the human factor and capital can produce revenue, whereas in the case of most other classes of land the land is the main factor and the man and capital the medium. Whatever it turns out to be is in exact proportion to what is put into it. The land itself is not an asset; it is in fact a liability. Owing to the varying nature of pumice land its development up to a revenue-producing pitch is not a clear-cut job. It is a process in which time plays the largest part; the poorer the land the longer it takes. The more it costs the less revenue it produces and the quicker it depreciates if neglected. When once started the work must be finished if a man is to get his money back or a portion of his money back. To half do a job is no better than to leave it untouched."

Campbell's comments summarise the difficulties settlers found in developing pumice land before the introduction of Certified perennial ryegrass. The normal practice then was first to sow a temporary pasture consisting mainly of red clover; that was followed by a crop of swedes, and the land then sown to what was hoped would be permanent grass after the swedes. However, the almost-universal use of false perennial ryegrass resulted in a pasture of low production after the first two years, when the ryegrass and red clover disappeared.

In short, the development of pumice land under these conditions was hardly economic, and the State projects made a drastic alteration in the method of approach to the establishment of permanent grass. Instead of expending time and money in the slow business of raising soil fertility through successive crops of grass and clover, the methods used aimed at making the permanent pasture itself raise the soil fertility. The essential features of this method were adequate cultivation so that a satisfactory establishment of grass and clover was secured, the use of Certified perennial ryegrass seed, the liberal use of superphosphate so that a strong white clover growth was secured, and controlled grazing so that the resulting strong pasture growth was consumed and the land heavily manured with the resulting animal droppings.

In development the scrub was first cut and burned, and the land ploughed, rolled on the furrow, double disced, harrowed, and rolled; then grass and clover seed were sown with 3cwt. of superphosphate. Another 3cwt. of superphosphate was applied three to six months after sowing and a further 3cwt. within 12 months. That additional 6cwt. of superphosphate during the first year provided just that necessary stimulus to white clover to provide a complete ground cover, stimulate the ryegrass, and provide the necessary herbage to enable a high concentration of livestock to be maintained with pasture.

[*National Publicity Studios photo.*

A Waikato fat lamb farm. Fat lamb production made great progress in the Waikato during the 1920-45 period, and breeding ewes which were formerly shipped from Gisborne to Canterbury were largely diverted to the Waikato, which now requires annually about 300,000 breeding ewes from hill-country pastoral areas.

Cobalt and Bush Sickness

The discovery of the use of cobalt to prevent bush sickness was another factor in developing the pumice lands of the Central Plateau area. It enabled not only the development of new land but also increased stocking of land already grassed, for bush sickness had held up farm development not only on the Central Plateau area but also over an extended area covered by the bush-sick ash showers.

Tauranga and Rotorua Counties contain large areas of bush-sick lands, and farm development in those counties illustrates the advance made as soon as the disease could be controlled. Up to 1930 the settlers faced an unequal struggle against bush sickness and a number of farmers abandoned their holdings. The abandoned holdings rarely went completely out of production, as they were used as run-off grazing areas by farmers in other districts. During the period 1930-35 limonite was used with partial success in controlling the disease and the State developed considerable areas of scrub land. In 1935 cobalt topdressing was introduced and had a marked effect on the development of sheep farming, for lamb fattening became practicable. The rise in the numbers of breeding ewes and cows in milk in Tauranga and Rotorua Counties between 1925 and 1945 is shown in Table VI.

TABLE VI—BREEDING EWES AND MILKING COWS IN ROTORUA AND TAURANGA COUNTIES, 1925-1945

	Breeding ewes		Milking cows	
Year	Rotorua	Tauranga	Rotorua	Tauranga
1925	17,171	5,919	3,927	22,031
1930	23,094	15,553	5,786	32,376
1935	40,669	30,117	10,261	49,825
1940	56,635	66,934	11,931	52,571
1945	88,921	132,850	10,241	53,387

Not only did the number of breeding ewes increase very considerably but the composition of sheep flocks changed, as is shown in Table VII.

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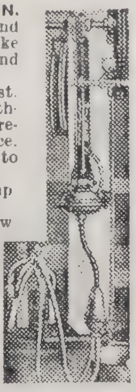

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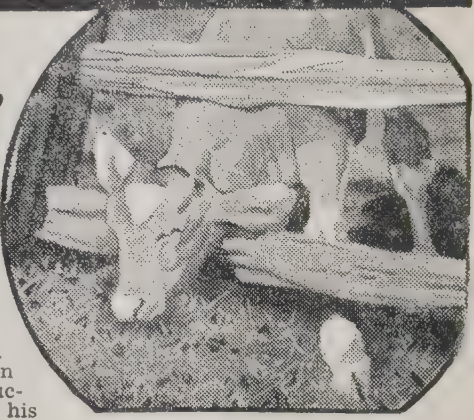

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TABLE VII—WETHERS AND DRY EWES AS A PERCENTAGE OF BREEDING EWES AT APRIL 30 IN ROTORUA AND TAURANGA COUNTIES, 1925-1945

Year	Rotorua	Tauranga
1925	48.9	168.0
1930	36.9	55.1
1935	22.5	23.6
1940	33.3	19.9
1945	37.5	15.2

In the early part of the period lamb fattening was possible on only a few areas free from bush sickness. Until the use of limonite and later of cobaltised superphosphate it was impossible to carry lambs beyond Christmas of each year, and the normal practice in sheep farming was to quit all lambs and ewes in November or early December.

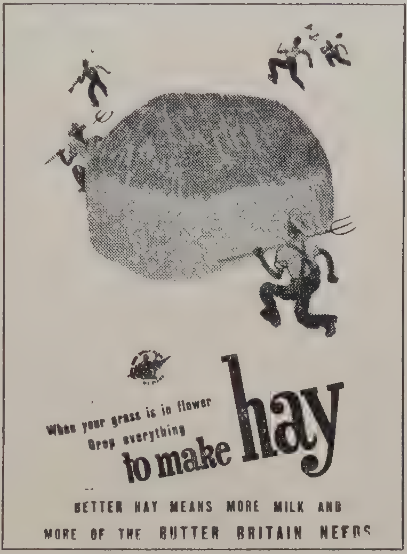
Reversion

Some of the difficulties encountered by settlers developing pastoral farms by surface sowing after bush burns in the high-rainfall areas were described in the previous article in this series, but the problem reached serious proportions during and immediately after the First World War. Blame for reversion has frequently been attached to the type of grass mixture originally sown, which usually consisted of ryegrass, cocksfoot, and clovers. As soon as the initial high fertility derived from the ashes of the burn fell white clover went out, followed by ryegrass and cocksfoot, the carrying capacity fell, and the bare ground was occupied by fern and manuka. Had the majority of the original mixtures contained browntop, danthonia, crested dogstail, and *Lotus major*, reversion would not have been as marked as it has been, but the use of a sound seed mixture could be only the foundation of the battle against secondary growth in the high-rainfall areas. Crushing with stock, clearing up logs, and resowing reverted areas should have been more widely carried out if reversion was to have been checked.

The problems caused by widespread reversion led to the passing of the Deteriorated Lands Act 1925—"An Act to make Provision for the Relief of the Occupiers of certain Crown and other Lands in respect of Hardships due to Deterioration of such Lands or to their Natural Lack of Productivity." Revaluation committees were set up under the Act with power to revalue the land and to recommend remission of rent or interest, consolidate and reclassify farms, recommend advances, and define the purposes for which advances should be made. Here are two reports of the revaluation committees:—

1. Farm of 1129 acres, of which 1100 acres of bush land have been felled and grassed, and consisting of 600 acres reverted to fern, 500 acres of poor pasture, and 29 acres of standing bush. The farm carries 400 ewes, 200 dry sheep, and 70 cattle. The carrying capacity could be increased a little with topdressing and should show better returns, but unless it is topdressed the carrying capacity will decline still further.

2. Farm of 800 acres, of which 230 acres are in fair pasture, 328 acres in second growth and fern, and 242 acres in standing bush; carrying capacity, 450 ewes and 20 cattle; a very poor section and one on which an enormous amount of money has been lost. There are only 23 acres of the section worth farming; the balance is all poor hills, with cliffs and bluffs. It is all running back to fern and second growth. Carrying capacity on the whole will decrease and cannot be improved. If the 230 acres of the farm near the road could be kept clear and topdressed, it would carry stock for an indefinite period, but the remainder of the section is not worth trying to save.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Rent remissions and advances were spent on fencing, topdressing, and regrassing after secondary burns. A good deal of improvement was effected, but much of it was lost during the early depression years. The technique of regrassing after secondary burns was thoroughly investigated by E. B. Levy, who advocated the wider use of danthonia, browntop, crested dogstail, and *Lotus major* for this purpose. The rejuvenation of much of the reverted country through secondary sowings, topdressing, and wider use of cattle for crushing and pasture consolidation is a process that may take time but is yearly adding stock-carrying capacity to the reverted areas in some localities.

The Lands Department began the rejuvenation of large areas of abandoned land in the King Country (Western Uplands district Fig. 1) in the late depression years of the 1930's, and the example in improvement work thus set has since been followed by an increasing number of settlers. The year 1935 marked the end of retrogression in the King Country, and since then a period of farming expansion has been in evidence, more especially in Kawhia, Waitomo, and Taumarunui Counties. In the 20 years from 1925 to 1945 the King Country district increased its total sheep numbers by 750,000, of which 500,000 were breeding ewes.

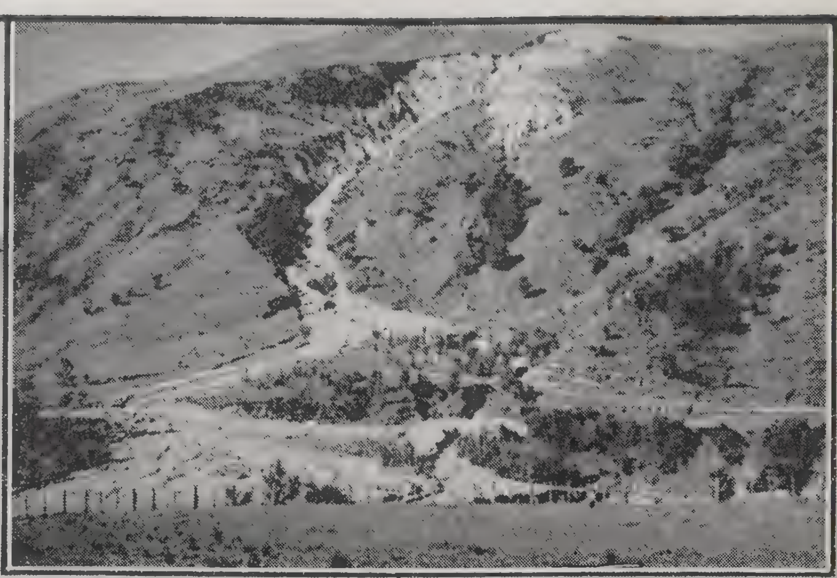
The striking fact is that despite reversion and abandonment, an almost-consistent increase in numbers of breeding ewes is recorded since 1920 in every county except Kaitieke, and even there the true position is obscured by the loss of some 30,000 acres to Taumarunui County between 1925 and 1930. Between 1925 and 1935 the area in sown grass in the King Country fell by 100,000 acres and since then the area under grass has remained much the same, but since 1935 sheep shorn per 100 acres of grass have increased by 60 per cent. in the Kawhia-Waitomo-Taumarunui area and by 30 per cent. in the Ohura-Clifton - Whangamomona - Kaitieke - Waimarino area. The numbers of breeding ewes and total sheep in the King Country counties for 1925 and 1945 are set out in Table VIII.

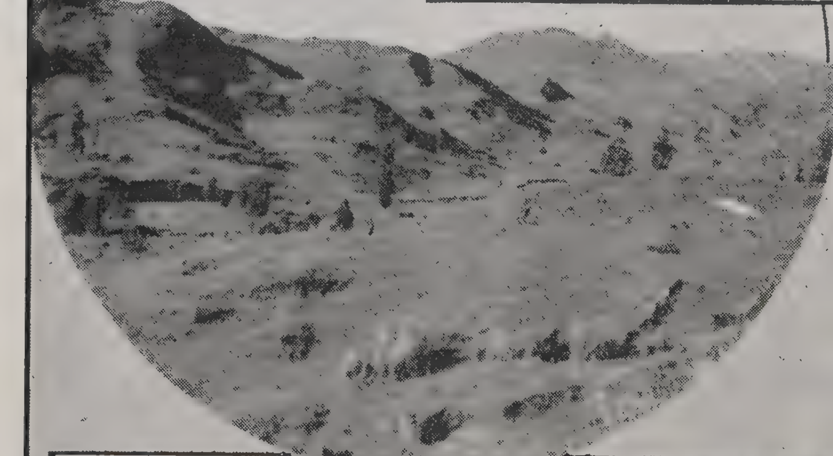
Though some of the increase in livestock numbers has been the result of the rejuvenation of reverted surface-sown lands, a much greater increase has occurred on the ploughable lands in the areas which have been topdressed. Progress in Kawhia County,

TABLE VIII—BREEDING EWES AND TOTAL SHEEP AT APRIL 30 IN KING COUNTRY COUNTIES, 1925 and 1945.

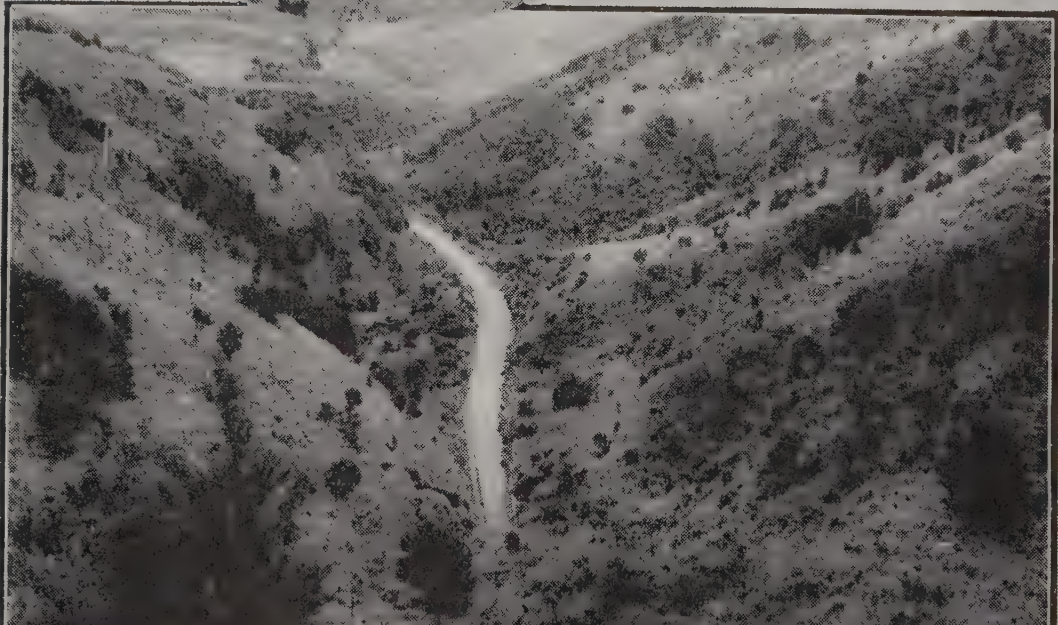
	1925		1945		Difference	
County	Breeding ewes	Total sheep	Breeding ewes	Total sheep	Breeding ewes	Total sheep
Waimarino	138,441	311,135	178,036	355,879	39,595	44,744
Clifton	39,389	73,398	89,417	135,442	50,028	62,044
Whangamomona ..	36,457	75,586	49,428	88,401	12,971	12,815
Waitomo	109,494	205,781	350,741	591,610	241,247	385,829
Kawhia	31,096	50,858	66,326	104,631	35,230	53,773
Ohura	71,288	143,573	106,446	205,020	35,158	61,447
Taumarunui	14,733	27,539	101,932	189,556	87,199	162,017
Kaitieke	69,039	147,164	66,860	119,191	—2,179	—27,973
	509,937	1,035,034	1,009,186	1,789,730	499,249	754,696

SURFACE-SOWN HILL-COUNTRY PASTORAL LANDS





The great developments in improved grassland farming which occurred on the flat and undulating lands of the Dominion in the 1921-45 period did not extend appreciably to the surface-sown hill-country pastures. Erosion (above) and reversion (below) lowered carrying capacity in many places, though the major part of the surface-sown pastoral area maintained an even level of stocking (left).



for instance, has been mainly the result of that.

Waitomo County shows the most marked development during the period under review. The county was originally covered in heavy mixed bush and open heaths of bracken fern and tutu. Large-scale farm development was begun about 1910, and by 1920 serious problems of reversion and deterioration were being faced by the settlers. Large areas of the open fern lands, grassed originally rather haphazardly after surface sowing, were deteriorating in productivity and farmers on surface-sown bush lands were faced with problems of reversion. Further, areas of the higher surface-sown bush land covered by the Mairoa shower were developing bush sickness. Those setbacks were not reflected in any decline in total stock numbers, for topdressing was increasing the productivity of pastures on most of the ploughable land within the expanding reach of road and rail transport. After 1935 the use of cobalt made it possible to farm much of the abandoned land prone to bush sickness, and the Lands Department developed very large areas of reverted and abandoned land.

The main part of Taumarunui County lies on the western edge of the Central Plateau, and the eastern part of this area is still unoccupied. The south-western pocket of the major area lies along the course of the Wanganui River, and it is this area, mainly developed after bush burns, which has deteriorated because of reversion. The main development in the county during the period has been largely the result of the development of pumice areas through the use of cobalt.

While easier country in other counties has improved, the steep surface-sown hill pastures, especially on sandstone, have deteriorated. Ohura, Kaitieke, Whangamomona, and parts of Clifton and Waimarino have suffered severely from reversion. There has been abandonment of the poorer country and a concentration on the better land by the greater use of breeding ewes.

The King Country is not the only district where reversion has occurred; it is common to all the high-rainfall surface-sown areas, where large areas of pasture land have been lost through the invasion of bracken fern, hard fern, piripiri, manuka, fuchsia, and wineberry. On much of the grazed country there still exists an uneasy balance between pasture and reversion. In high-rainfall areas and on poor soils hard fern gradually encroaches on the pastures, and with lowered stocking bracken comes in. The bracken shades out the hard fern and the land is developed by resowing after a bracken burn, the cycle of hard fern encroachment slowly starting again. In the areas where soils are drier or rainfall moderate, manuka reversion is commonest. Though the King Country has large areas which have reverted badly, the more intensive methods employed on the ploughable land have masked the main effects of reversion, but in some other districts reversion, coupled with pasture deterioration accentuated by sheet erosion, has led to an almost stationary position in the number of livestock carried. That is well illustrated in Table IV, which shows breeding ewe numbers by North Island districts.

The position in the east coast district deserves some comment, for there the number of breeding ewes declined by 73,000 between 1925 and 1945. The district comprises Opotiki, Matakaoa, Waiapu, Uawa, Waikohu, and Cook Counties and is generally steep, broken country on either side of the Raukumara Range, which forms the mountain backbone of the peninsula. Settlers have been faced with problems of reversion, erosion, and slumping of the hills. Sheep numbers reached their maximum in the 1925-30 period, declined to about their present level in 1935, and since have remained fairly stationary. The recovery of stability has been brought about mainly by increased attention to cattle, and the increase in the proportion of cattle to sheep is shown in Table IX.

TABLE IX—BEEF CATTLE PER 100 SHEEP SHORN IN EAST COAST DISTRICT

County	1920	1925	1930	1935	1940	1945
Opotiki	7.82	9.22	7.40	8.22	11.91	10.65
Matakaoa	N.A.	8.19	7.86	12.69	12.21	13.34
Waiapu	6.67	8.92	8.86	11.91	12.41	13.00
Uawa ..	6.91	8.78	7.33	11.41	11.46	11.03
Waikohu	9.39	11.21	11.91	13.29	13.22	14.78
Cook ..	7.78	10.46	9.62	11.62	12.13	12.84

An even higher ratio of cattle to sheep than that now general is probably necessary if the North Island surface-sown grazing lands are to be maintained at their present carrying capacity. Cattle are required to clear up rank pasture growth and crush out bracken fern and other undesirable vegetation. Winter keep is the main problem in maintaining a high proportion of cattle to sheep on hill country, and the position is unlikely to be improved until suitable edible shrubs are found for planting on hill country to provide winter feed for cattle. On country which cannot winter sufficient cattle more use could with advantage be made of wethers, which may partially take the place of cattle, but the supply of wethers has fallen in recent years because of the increased development of the fat lamb trade.

Deterioration and Depletion

While reversion and erosion have raised serious problems on surface-sown hill country, the course of deterioration and depletion has continued on the tussock grasslands of the South Island. The Pastoral Lands Commission (1920) in the report on its inquiry into terms of lease and causes and extent of the deterioration of the tussock grasslands drew attention particularly to the need for systematic spelling of the natural pastures to allow regeneration and the suppression of rabbits. It found that the main causes of deterioration and ultimate depletion were:—

1. Burning the tussocks, especially at the wrong season.
2. Overstocking with sheep.
3. Continuous grazing for 70 years without attempt at improvement.
4. Allowing rabbits to become extremely numerous.
5. The tenures under which the land has been and is being held and some of the conditions of such tenures.

The Commission stressed the need for spelling and the production of winter feed, stating: "Spelling is a most powerful weapon in the hands of one wishing to improve his upland pastures. How can a pasture grazed year in and year out, even at the time of seeding, be expected to remain at its best? It must deteriorate. Witness in this regard the constant grazing for nearly 70 years of the mountain tussock grasslands. No wonder they have deteriorated; the marvel is they are not worse. It is this growing of winter feed which is greatly assisting to make the small runs of Central Otago profitable and increasing their carrying capacity. Here, happily, lucerne can be grown in greatest luxuriance by the aid of irrigation."

The lowering effects on carrying capacity of pasture deterioration on the one hand and the benefits from the production of lucerne hay for winter feeding in Central Otago on the other hand, for instance, are somewhat difficult to assess from available statistics. Table X gives the numbers of breeding ewes in South Island districts between 1925 and 1945 and, as is shown in Table IV for the North Island, the main increases have occurred in districts which have adopted intensive grassland farming practices.

However, the Mackenzie and Central Otago districts are chiefly devoted to sheep farming on tussock grasslands, and the variation in numbers of livestock carried in those districts may be used to illustrate a discussion on the effects of depletion on carrying capacity during the period under review. Both districts show an increase in the number of breeding ewes and total sheep, but a more detailed review of the composition of flocks and other factors indicates that the position is not quite as favourable as it at first appears.

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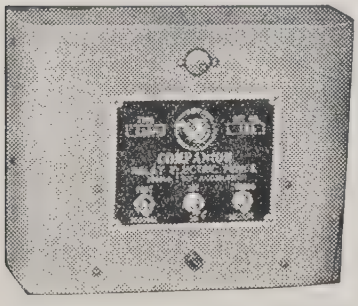

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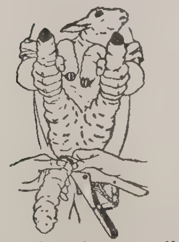

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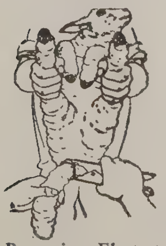

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TABLE X—BREEDING EWES BY SOUTH ISLAND DISTRICTS, 1925 and 1945

*District	Breeding ewes (000 omitted) 1925	Breeding ewes (000 omitted) 1945	Increase (000 omitted)
West Coast ..	41	58	17
Nelson	233	260	27
Marlborough ..	538	592	54
North Canterbury	553	645	92
Foothills ..	411	455	44
Plains	213	300	87
Christchurch ..	15	25	10
Banks Peninsula	170	194	24
South Canterbury	1,625	1,964	339
Mackenzie ..	272	283	11
Otago	460	683	223
Central Otago ..	454	632	178
Southern ..	1,227	2,842	1,615
South Island† ..	6,251	8,976	2,725

* See Fig. 2 showing district groups of counties.

† Includes Stewart Island and Chatham Islands, which are not included in any district total.

Mackenzie County is almost entirely devoted to high-country sheep farming and is an area where in the past fairly-severe deterioration of the native tussock grasslands has taken place. Table XI shows the number of breeding ewes and total sheep in Mackenzie County between 1920 and 1945 and the percentage of total sheep which were Merinos.

TABLE XI—BREEDING EWES AND TOTAL SHEEP IN MACKENZIE COUNTY, 1920-1945

Year	Breeding ewes	Total sheep	Merinos as percentage of total sheep
1920	271,732	473,871	19.1
1925	272,327	492,364	30.5
1930	327,194	604,427	32.3
1935	310,800	559,836	33.5
1940	312,659	564,669	31.3
1945	282,967	532,381	27.8

Sheep numbers increased from 1920 to 1930 and remained fairly high until 1940, when a decline set in. The causes for the increase between 1920 and 1930 are given as greater control of rabbits, some regeneration of the native pastures, and an increase in the number of Merino sheep, which are more adapted to the high country than half-breds. The main causes of decline since 1940 were heavy snowstorms in 1941 and 1943, when stock losses were considerable, and a swing away from the Merino.

Though there was a considerable increase in numbers of breeding ewes and total sheep carried in the Central Otago district comprising Lake, Vincent, and Maniototo Counties between 1920 and 1945, the problem of pasture depletion is still serious and irrigation has been an important factor in increasing the sheep-carrying capacity of Vincent and Maniototo Counties. Table XII gives the numbers of breeding ewes and total sheep for each county in 1920 and 1945.

TABLE XII—BREEDING EWES AND TOTAL SHEEP IN VINCENT, LAKE, AND MANIOTOTO COUNTIES, 1920 and 1945

County	1920 Breeding ewes	1920 Total sheep	1945 Breeding ewes	1945 Total sheep	Increase Breeding ewes	Increase Total sheep
Vincent ..	146,295	297,136	258,950	482,769	112,655	185,633
Lake	94,782	222,557	126,686	268,839	31,904	46,282
Maniototo ..	142,824	291,967	245,944	460,197	103,120	168,230
	383,901	811,660	631,580	1,211,805	247,679	400,145

From 1920 to 1930, while the price of fine wool was high, irrigation was expanding, and the rabbit was being vigorously checked, sheep numbers rose rapidly. In the irrigation areas lucerne for hay for winter feeding, as well as irrigated pastures, helped to swell the sheep numbers; breeding ewes reached their maximum in 1939 and since then have declined slightly in all counties. The main area of depleted and deteriorated tussock grassland in the district is in the middle basin of the Molyneux or Clutha River, where most native pasture plants have disappeared through constant burning, depredations of rabbits, and overgrazing. Much of it is too steep or too broken for irrigation, which has been used to regenerate the depleted flat areas.

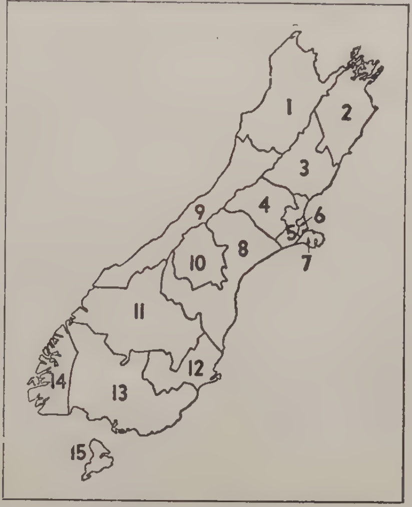


Fig. 2—South Island, showing groups of counties. 1. Nelson. 2. Marlborough. 3. North Canterbury. 4. Foothills. 5. Plains. 6. Christchurch. 7. Banks Peninsula. 8. South Canterbury. 9. West Coast. 10. Mackenzie. 11. Central Otago. 12. Otago. 13. Southern. 14. Fiord. 15. Stewart Island.

Rabbits are one of the main causes in accelerating pasture deterioration and depletion. The total annual harvest of rabbit skins in New Zealand is about 10,000,000, of which about 4,000,000 come from Central Otago. At present, with high prices for skins and consequent heavy trapping, the rabbit population is being held more or less stationary. If any recession in present prices occurs, the pest is likely to increase rapidly, with consequent deterioration of the tussock grasslands.

Though the sheep statistics quoted for the Mackenzie and Central Otago districts do not show that there has been any decline in carrying capacity on the tussock grasslands during the 1920-1945 period, the problem of pasture deterioration in the districts is still serious. It can be overcome only by controlling the rabbit pest and erecting sufficient fencing for portions of the grazing runs to be closed to stock to allow natural regeneration. However, the cost of those operations in relation to the returns from the land so far has precluded any major effort in this direction.

Erosion

The effects of erosion in reducing the fertility of large areas of hill country began to receive increasing public attention shortly before the outbreak of the Second World War, and that interest culminated in the passing of the Soil Conservation and Rivers Control Act 1941—"An Act to make Provision for the Conservation of Soil Resources and for the Prevention of Damage by Erosion and to make Better Provision with Respect to the Protection of Property from Damage by Floods." The Act sets up a Soil Conservation and Rivers Control Council, which is given the general control of soil erosion problems and works through boards having the control of river catchment areas.

In the end the control of erosion must rest very largely in the close co-ordination of effort between the boards and the occupiers of hill-country grazing lands. The occupiers of the land must carry out most of the works necessary to stabilise the land, though financial assistance may be necessary. The erection of debris dams to hold soil run-off from the hills, spaced tree planting to prevent slipping, fencing, controlled grazing, and pasture improvement must all receive the attention of the occupiers of the land if erosion is to be checked.

Pig Broadcasts

UNDER the auspices of District Pig Councils broadcasts will be delivered in January as under:—

Auckland—1YA, on January 21, at 7.15 p.m., "Showing Pigs at Agricultural Shows," by F. Barwell, Supervisor, Bay of Plenty District Pig Council.

Wellington—2YA, on January 15, at 12.35 p.m., "Plan to Increase Pig Production Next Season," by I. H. Owtram, Supervisor, Taranaki District Pig Council.

Simple Hay Baling Wire Straightener

By A. J. KERSE, *Fields Instructor, Auckland.*

BECAUSE of the difficulty in getting supplies of baling wire, farmers are being advised to save the wire off hay bales when feeding out so that it may be used again next season. Nothing is more awkward than a heap of tangled baling wire which has to be straightened and tested for strength and stored in good order until it can be used again next season, but with the simple device shown in the sketch, which was seen on the farm of Mr. A. V. Hill at Mauku recently, wires may be stretched, straightened, tested, and sorted into bundles for easy handling.

THE farmer who designed this simple stretcher recommends that the wire be dealt with frequently, otherwise the heap of wires is not easy to handle.

Materials required to make the stretcher are a piece of timber 4in. x 2in. or 6in. x 2in. 8ft. 6in. long and a piece of timber about 2ft. long of the same size for a handle.

The handle (D in the upper illustration) is fixed to the bottom plate (B) by a T hinge and a hole (C) is bored through the handle about 3in. up from the hinge end. (It may be necessary to cut a little off the hinge arm to allow for boring this hole.)

A 6in. nail (A) is driven just over two-thirds in 2 or 3in. from the end of the bottom plate opposite the handle and turned over, leaving say 1½in. protruding so that the loops of the wires can be quickly hooked on. A second nail a few inches further up the bottom plate is handy to take wires which may be a little shorter.

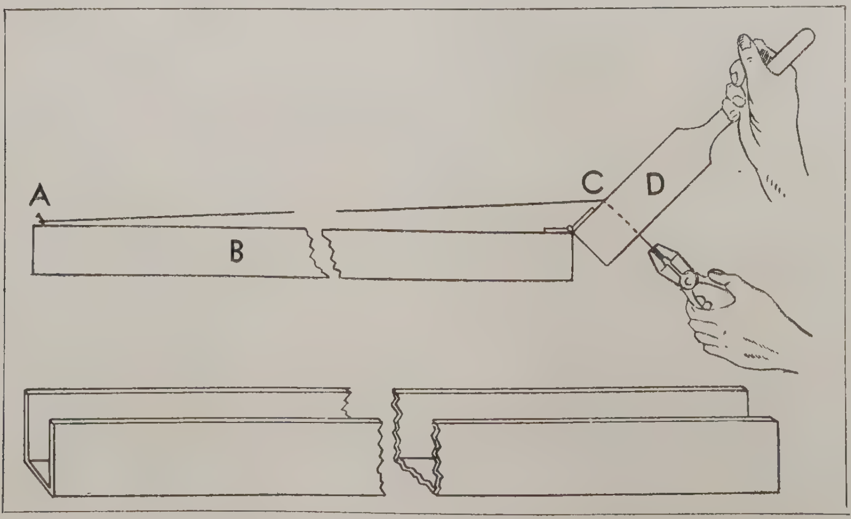
The wire is hooked on to the nail and the other end fed through the hole in the handle and held with one hand with a pair of pliers and the handle given a good firm pull with the other hand sufficient to straighten the wire and test it for strength. Wires which are going to break when the strain comes on in the baler are better weeded out.

When the wires have been straightened they are best put into a box similar to that shown in the lower illustration, with all the loops at one end. If two short pieces of wire are first put across the box about 2ft. from each end, when a number of wires, say 100, have been laid on top these short pieces can be tied to make a compact bundle.

This box should be 8ft. 6in. long, but other dimensions can be varied. A suitable size could be made with an 8in. x 1in. board for the bottom and two 6in. x 1in. boards for the sides. Ends are not necessary. There is no advantage in having the bundles too big, and bundles of 100 are easily handled and counted.

Before tying the bundles up it is a good idea to drip some waste oil into the box to work through the wires and help to prevent rusting.

To follow up this system of bundling the wires a very good idea seen on Messrs. Pearson Bros.' farm at Patumahoe consisted of two boxes of approximately the same size, one on each side of the hay baler, so that the bundles of wire can be laid in and drawn out from the end of the bundle one at a time by the operators. These boxes on the baler must have a lid so that the wires are pulled out by the loop at the ends, otherwise they will not come out cleanly.



SHOW DATES

January 1—Nuhaka A. and P. at Nuhaka.
January 9 and 10—Wairoa County A. and P. at Wairoa.
January 10—Blueskin A. and P. at Waitati.
January 17—Waiau A. and P. at Tuatapere.
January 17—Waikouaiti A. and P. at Waikouaiti.
January 23—Palmerston and Waihemo County A. and P. at Palmerston.
January 23 and 24—Taumarunui and District A. and P. at Taumarunui.
January 24—Golden Bay A. and P. at Takaka.
January 24—Marton District A. and P. at Marton.
January 26—Helensville A. and P. at Helensville.
January 29—Tauranga A. and P. at Tauranga.
January 30 and 31—Horowhenua A. and P. at Levin.
January 31—Waipukurau A. and P. at Waipukurau.
February 3 and 4—Feilding I. A. and P. at Feilding.
February 5 and 6—Feilding Ram Fair at Feilding.
February 6 and 7—Taranaki Metropolitan A. and P. at New Plymouth.
February 7—Woodville A. and P. at Woodville.
February 7—Hukerenui A. and P. at Hukerenui.
February 7—Waihi A. and P. at Waihi.
February 7—Clevedon A. and P. at Clevedon.
February 10 and 11—Dannevirke District A. and P. at Dannevirke.
February 12—Dannevirke Ram Fair at Dannevirke.
February 14—North Kaipara Agricultural Association at Paparoa.
February 14—Pahiatua A. and P. at Pahiatua.
February 14—Murchison A. and P. at Murchison.
February 14—Te Awamutu A. P. and H. at Te Awamutu.
February 18—Opotiki A. and P. at Opotiki.
February 20 and 21—Buller A. and P. at Westport.
February 20 and 21—Ohura A. P. H. and I. at Nihoniho.
February 20 and 21—Masterton A. and P. at Masterton.
February 20 and 21—Franklin A. and P. at Pukekohe.
February 21—Whakatane and Rangitaiki A. and P. at Whakatane.
February 21—Banks Peninsula A. and P. at Little River.
February 23 and 24—Masterton Ram Fair at Masterton.
February 27 and 28—Auckland Metropolitan A. and P. at Auckland.
February 28—Waimarino A. P. H. and I. at Raetihi.
February 28—Te Puke A. and P. at Te Puke.
February 28—Waipapu P. and I. at Ruatoria.

Sub-tropical Fruits Can Still Be Greatly Improved

THE importance of using clonal, true-to-name, and heavy-yielding stocks of black currants, loganberries, and raspberries has been explained in articles in the October and November issues of the "Journal." In concluding this series J. P. Hudson, Horticulturist, Wellington, deals with the question of improving the sub-tropical fruits which have become so popular during the last few years and the part which clonal races will play in the future cultivation of these fruits.

MOST of the common fruits have been in continuous cultivation for hundreds of years, and although all of them are descended from wild plants, they often bear little resemblance now to the wildings from which they originally sprang. No one would grow a crab apple for eating when he could grow a Cox's Orange Pippin, nor would wild strawberry plants be worth a place in the fruit garden compared with the modern cultivated varieties that yield far heavier crops of better berries.

Although the old-established fruits are an enormous improvement on the wild forms, some of the sub-tropical fruits, such as tree tomatoes, feijoas, etc., which have come into such favour within recent years are still little changed from their wild forms.

They are, however, as capable of being improved as the crab apple and wild strawberry, and these fruits offer a most interesting field for future development, but before considering what could be done to improve them it would be worth while to trace the processes by which the various varieties of fruit have been originated.

Wild Plants Improve Under Cultivation

The first step has usually been to select some plant growing wild and give it special attention—to introduce it to cultivation. In the early days of history, before man developed horticulture into an art, this cultivation would probably consist mainly of clearing away neighbouring trees or plants and later growing local fruits in an enclosed garden where they would be safe from attacks by roaming cattle. Now, of course, the whole world is being systematically combed for new and promising plants by professional collectors who send seeds or plants back to the botanical gardens and nurseries where they can be grown on under ideal conditions.

The first effect of cultivation on these wild plants is usually to make them grow more luxuriantly and produce finer fruits than they ever would in nature, where they are in constant competition with other plants for water, food, and light.

There is, however, a limit to the improvements which cultivation can bring about, and these improvements are not in any way permanent (plant breeders call them "fluctuations"), because the plants soon slip back to their normal habits if the efforts of the cultivator are relaxed. The improvements are temporary only, and not inherited by the next generation of plants, although, of course, these will also respond to cultivation in the same way as their parents.

Apples, pears, strawberries, and other old-established fruits have long since passed the initial stage of improvement from the wild forms, but some of the newer fruits, such as the Chinese gooseberry and tree tomatoes, are still at this stage, having been introduced into cultivation from the wild but being so far little altered from the natural forms, except for the general improvement in size, vigour, and health as the result of cultivation.

Two Ways of Improving Plants

How, then, can improvement of these popular sub-tropical fruits be effected as it was with apples and other fruits generations ago?

The appearance and character of every plant and animal are due to its hereditary make-up, and permanent improvements in a plant can be brought about only by altering this make-up in some way. This can be done by taking steps to change it (hybridising), by taking advantage of some natural change (mutation), or by a combination of these two methods, both of which should be very clearly understood by anyone interested in improving plants.

Natural changes in hereditary make-up—known variously as mutations or sports—are a very important source of new varieties and of plant improvement generally and growers should always be on the look-out for them. They occur naturally and comparatively rarely, but may affect any part of the plant, including flower and fruit, and any character, such as size, flavour, colour, quality, etc.

It is not fully understood how or why mutations occur, nor is there any reliable way of making them occur "to order." All that can be done is to keep a very sharp look-out for them so that any useful mutations can be used when they do occur. Thus a tree bearing red fruits may produce a branch bearing only yellow ones, or a few fruits may be much sweeter than usual or have thinner skins. Seeds from the affected part of the tree usually "breed true," that is, they pass the new character on to their offspring.

The other outstanding way in which plants can be permanently improved is by hybridising, in which case two plants with different characters are crossed together and a careful selection made of the offspring, rejecting undesirable types and choosing only those which show most of the desirable characters of both parents. This selection may have to be made for several generations before the breeder is satisfied, but he usually raises large numbers of seedlings of each generation to increase the chances of finding a really satisfactory one.

Most Fruits are Hybrids

Hybridising enables the breeder vastly to improve on nature, as characters can be combined from plants of widely-different origin that would never have come together naturally. The garden strawberry is a good example of this, having as its ancestors a North American species with berries that were tiny but well-flavoured and a species from South America which had large berries but no flavour. Skilful breeding, made possible by the plant collectors who sent both species to Britain, has resulted in the present varieties which combine large fruits with good flavour. It is outstanding successes such as this that make plant breeders study new introductions so keenly, especially when they are related to present crop plants, because the most unpromising newcomer may have some character that could with advantage be incorporated into the commercial types.

Fruits Need Not be "Fixed"

In the case of annuals, such as sweet peas, a new variety has to be "fixed" before it can be put into commerce—that is it must breed true from seeds, and this may involve years of patient work on the part of the breeder, but the fruit grower is more fortunate. A new variety of fruit can be propagated vegetatively, by budding, grafting, cuttings, layers, suckers, etc., thus giving rise to a clonal race each plant of which is exactly like the original, although not capable of breeding true from seed.

Hybridising between plants which are very similar is not likely to produce an outstanding new variety, since there may be little difference in the hereditary make-up of the plants used for crossing, and the offspring as a rule vary only within the range of variations found between the parents.

This applies especially to plants like the sub-tropical fruits that have been introduced to cultivation recently and are still relatively uniform. In these cases the best hope of a major improvement lies in a chance mutation which not only offers scope for vegetative propagation of a new variety but also provides new hereditary material on which the plant breeder can work.

The general method of improving a fruit such as the tree tomato or Chinese gooseberry is, therefore, to keep a close watch for a plant (or part of a plant) the fruits of which show an improvement over the normal type. When this occurs cuttings or scions should be taken from the improved part, propagated vegetatively, given a variety name, registered as a new variety with the Royal New Zealand Institute of Horticulture (Inc.), and put out into commerce. This named variety must then always be propagated vegetatively, as the name cannot justly be applied to seedlings from it. Varieties of fruits can be given a varietal name only if they are true clonal races.

Not only should the clone be put into commerce as a named variety, but plant breeders should use it in hybridising with other types, because the sport will have introduced new hereditary material which may lead to a whole range of improved varieties, as the Spencer sweet pea led to very many new varieties with frilled standards.

It is most important that fruit growers should be quick to notice the slightest useful variation in their plants, as this may provide the breeder with a valuable new character, even if the sport is not directly usable as a new variety.

There is plenty of room for improvement in sub-tropical and other fruits, and it is hoped to stimulate interest and encourage the introduction of new, named, and improved varieties of tree tomatoes, Chinese gooseberries, feijoas, passion fruits, guavas, and other similar fruits.

What to Aim For

Among the characters of sub-tropical fruits which could be improved are:—

The tree

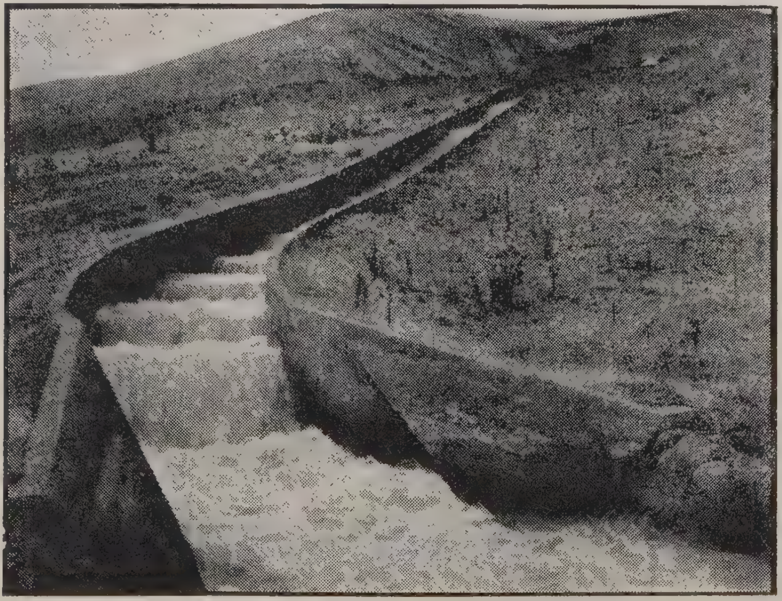
- Earlier and later varieties;
- Resistance to frost and wind;
- Greater vigour and fruitfulness.

The fruit

- Ease of picking;
- Attractiveness of shape and colour, and convenience of size;
- Thinner, less hairy (Chinese gooseberry), less bitter (tree tomato), and freer skins;
- Improved texture, flavour, and juiciness;
- Absence of woody pieces in the flesh of tree tomatoes and Chinese gooseberries;
- Better travelling and keeping quality in feijoas, etc.

Growers or nurserymen who put into circulation named varieties of these fruits propagated vegetatively and with some or all of these improvements will have deserved well of fruit growers and the consuming public and will help materially to put the sub-tropical fruit industry on a sounder footing. Growers will be able to plant trees of known capacity which will fulfil their requirements in the same way that growers of pip and stone fruits can now plan their production by planting well-known varieties of known performance.

Water Stairway in Central Otago



[*National Publicity Studios photo.*

This water stairway in the Manuherikia irrigation race in the Waikerikeri Valley, Central Otago, built by the Public Works Department in 1931, conveys a flow of water of up to 26 cubic feet per second through a fall of 114ft. in the short distance of 200 yards. Although this portion of the race, which is 7ft. wide and a little more than 5ft. deep, has the appearance of a stairway, the "stairs" are cross walls spaced about 6ft. apart and about half the height of the side walls of the race. It is estimated that if the flow of water was not broken in this manner an equivalent of 340 horsepower would be developed, which would make the flow almost unmanageable at the lower end and create serious erosion problems in the channels. The velocity of the water is so checked by the cross walls that when the water arrives at the bottom it has little more energy than that given it by its fall from the last step. (Information supplied by the Resident Engineer, Public Works Department, Alexandra.)

Royal Commission on Sheep Industry

The following is the itinerary of the Royal Commission on the Sheep Industry in the Gisborne district between January 12 and January 28:—

Monday, January 12—Arrive at Waikaremoana. Tuesday, January 13—Private sitting. Wednesday, January 14—Examination of country behind Wairoa; arrive at Wairoa at night. Thursday, January 15—Public sitting at the county council chambers, Wairoa. Friday, January 16—Field day with farmers on the Tiniroto country; return to Wairoa. Saturday, January 17—Field day with farmers on the country south and inland of Gisborne; arrive at Te Puia. Sunday, January 18—At Te Puia; reserved. Monday, January 19—Sitting at Tolaga Bay. Tuesday, January 20—Sitting at Ruatoria. Wednesday, January 21—Field day with farmers in the Te Araroa district. Thursday, January 22—Arrive at Opotiki. Friday, January 23—Sitting in Opotiki. Saturday, January 24—Field day with farmers in the Matawai district. Sunday, January 25—At Opotiki. Reserved. Monday, January 26—Field day with farmers in the Whakatutu district; arrive at Gisborne. Tuesday, January 27—Sitting in the county council chambers, Gisborne. Wednesday, January 28—Leave Gisborne.

Importance of Blind Seed Disease in Ryegrass

By **W. L. OSBORN,** ***Assistant Instructor in Agriculture, Timaru.***

THE germination capacity of seeds is an important consideration to farmers and merchants alike, and with the development of a small-seeds export trade it has become of great importance to New Zealand. Blind seed disease, causing low germination in ryegrass seed crops, therefore has been receiving increasing attention. A general survey of present knowledge of the disease and the investigations being carried out on the problem is given in the following article.

EARLY records show that ryegrass seed was unreliable in germination capacity 25 years ago. Even then in certain seasons crops gave seed of extremely low germination, but the reason was not discovered until 1932. Since then the main facts about the disease have become widely known, but research workers are still seeking economic methods of prevention and cure.

A fungous growth, now commonly known as "blind seed disease," was isolated and determined as the cause of the low germination of otherwise apparently-sound, well-harvested perennial ryegrass seed by Neill and Hyde, working at Palmerston North. Since their discovery the disease has been isolated in other countries, including England, Scotland, Wales, Ireland, Sweden, North America, Tasmania, and Victoria, and on grass seeds other than perennial ryegrass—among them short-rotation and Italian ryegrass, tall fescue, meadow fescue, chewings fescue, rye, and darnel.

Economic Importance

In New Zealand the economic importance of blind seed disease is considerable because primary production depends largely on the grassland type of farming. With the English ryegrasses the chief pasture species sown for the establishment and regeneration of grasslands throughout the country, large quantities of high-quality seeds have a ready market within New Zealand. Until recently the export trade in small seeds has flourished, with an increasing demand for high-quality New Zealand seeds from various countries. Ryegrass seed produced in New Zealand in the 1945-46 season exceeded 1,500,000 bushels, of which about a quarter was exported (Tables I and II).

However, the low germination of some ryegrass seed has become a problem to farmers and merchants alike. At its peak Certified Pedigree perennial ryegrass seed of high germination sold for more than £2 a bushel whereas for the low-germinating lines there is little or no sale. Throughout New Zealand seed firms are holding stocks of ryegrass seed that has a germination below 40 per cent., and some lines are as low as 5 per cent. To have harvested these lines, machine dressed the seed, and stored it for some time in seed stores has cost farmers consider-

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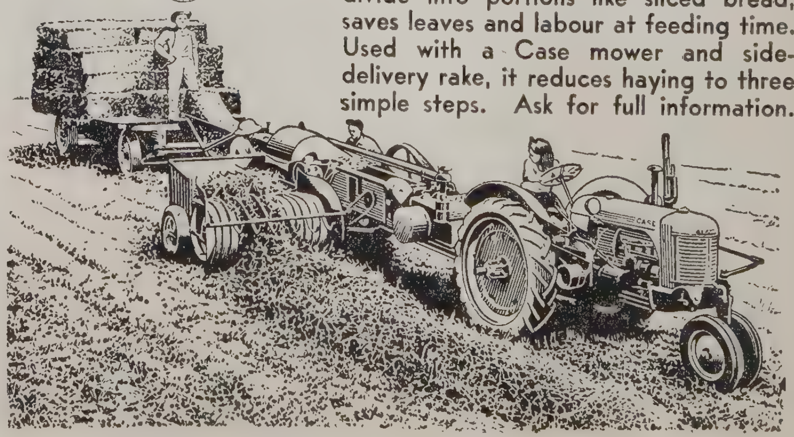

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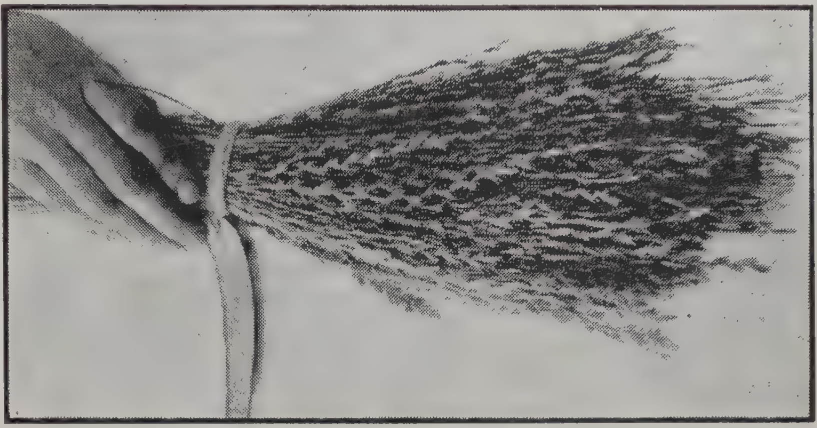


Sample of ryegrass for pre-harvest test for blind seed.

able time and money. In a bad year blind seed disease may involve the farmer in considerable financial loss. Seed crops may be proved worthless and, as well as the cost involved, there is the loss of production from high-producing ryegrass swards during the season and probable damage to the pastures in the process of letting them go for seed.

Unfortunately, the higher-producing, more persistent strains of the ryegrasses now available under the certification scheme of the Department of Agriculture are more susceptible to the blind seed fungus. Farmers who pay the very high prices for these seeds are more anxious to receive some return in the form of profitable seed crops. Blind seed disease is now so widespread in the seed-producing districts that farmers do not expect to secure high-germination crops every year.

To maintain an export trade high quality, moderate price, and a reliable and consistent supply are essential. With blind seed disease prevalent in New Zealand's major seed-growing districts those conditions cannot be fulfilled. With embargoes now in operation an improvement in the quality and reliability of seeds and a reduction in their cost become even more important. Thus the menace of blind seed disease in decreasing the value of New Zealand's ryegrass seed crops has become of vital importance to the industry and is being investigated by a large number of research workers in this country.

Description of Disease

The blind seed fungus (*Philea temulenta*) affects only the seed and does not damage the ryegrass plant. It grows through the tissues of the newly-formed seed and eventually kills it. It is not the only cause of low germination in a line of seed, but it has been found to be by far the most important in perennial, Italian, and short-rotation ryegrass.

The so-called "blind seeds" may not differ outwardly from healthy germinating seeds. A proportion of infected seeds, if infected after they have reached normal size and development and with ripening halting the progress of the fungous growth, are quite normal in size and colour, and until the outer husks or paleae are removed it is not possible to detect the damage or symptoms of the disease. However, seeds infected earlier, at flowering time, if they develop at all are small and shrunken, and the embryo of the seed is usually atrophied or withered away.

Life Cycle of Fungus

Infected seeds that have fallen to the ground from the seed heads or have been sown remain dormant during the following winter. During the early summer when temperature and moisture conditions are favourable the fungus revives and produces the next stage in the form of a mushroom growth (or apothecium) from the seed and protruding above the surface of the ground. These white, saucer-shaped mushrooms about ⅛in. in diameter, developed on a short, white, cylindrical stalk, can be found readily in ryegrass paddocks during November and December if the ground surface is examined carefully. Under humid conditions they have a life of eight to fourteen days, but they shrivel in a few hours if exposed to direct sunlight. With age their colour darkens to a cinnamon brown.

TABLE I: PRODUCTION OF RYEGRASS SEED IN NEW ZEALAND

	1944-45			1945-46		
	Total Acreage	Total Production (bushels)	Production under Certification (bushels)	Total Acreage	Total Production (bushels)	Production under Certification (bushels)
Perennial	47,287	689,499	405,656	58,345	1,032,103	550,675
Italian	17,547	389,178	221,807	21,013	507,858	284,288
Short rotation ..	300	6,150	6,150	2,500	48,499	48,499
Totals ..	65,134	1,084,827	633,613	81,858	1,588,460	883,462

TABLE II: EXPORT OF RYEGRASS SEED FROM NEW ZEALAND

	1945		1946	
	Exported to United Kingdom (bushels)	Total exported (bushels)	Exported to United Kingdom (bushels)	Total exported (bushels)
Perennial	145,936	249,424	145,600	280,000
Italian	195,040	249,872	53,760	95,000
Totals ..	340,976	499,296	199,360	375,000

Spores Infect Seed Heads

The mushrooms produce spores which, when ripe, are forcibly ejected and shoot upward for considerable distances to be carried by air currents to the flowering heads of ryegrass plants. These spores (called ascospores) mature in succession, so that their discharge may last for several days, and in that time several million spores may be ejected from one mushroom. As many as seven of these mushroom growths have been found growing from the one blind seed. Ryegrass heads become infected either by flying spores from within the crop or by wind-borne spores from outside sources of infection such as neighbouring paddocks.

Further Stage of Infection

The fungus attacks and penetrates the young seed and develops a further stage, which again produces millions of spores, this time enveloped in slime. The slime is readily soluble in water, so that spores (now called conidia) are carried and spread by rain or dew drops to other heads to produce the secondary infection of the disease.

Seeds infected earlier in their development from the mushroom ascospores either fail to complete their development or are small and light, so are likely to be removed in the machine dressing process. The secondary infection, however, takes place nearer to the ripening stage and the size and weight of diseased seeds may be quite normal. These blind seeds cannot be removed during the machine dressing of the line, and, being dead, remain in the dressed seed to give a lower percentage of germination to the line as a whole.

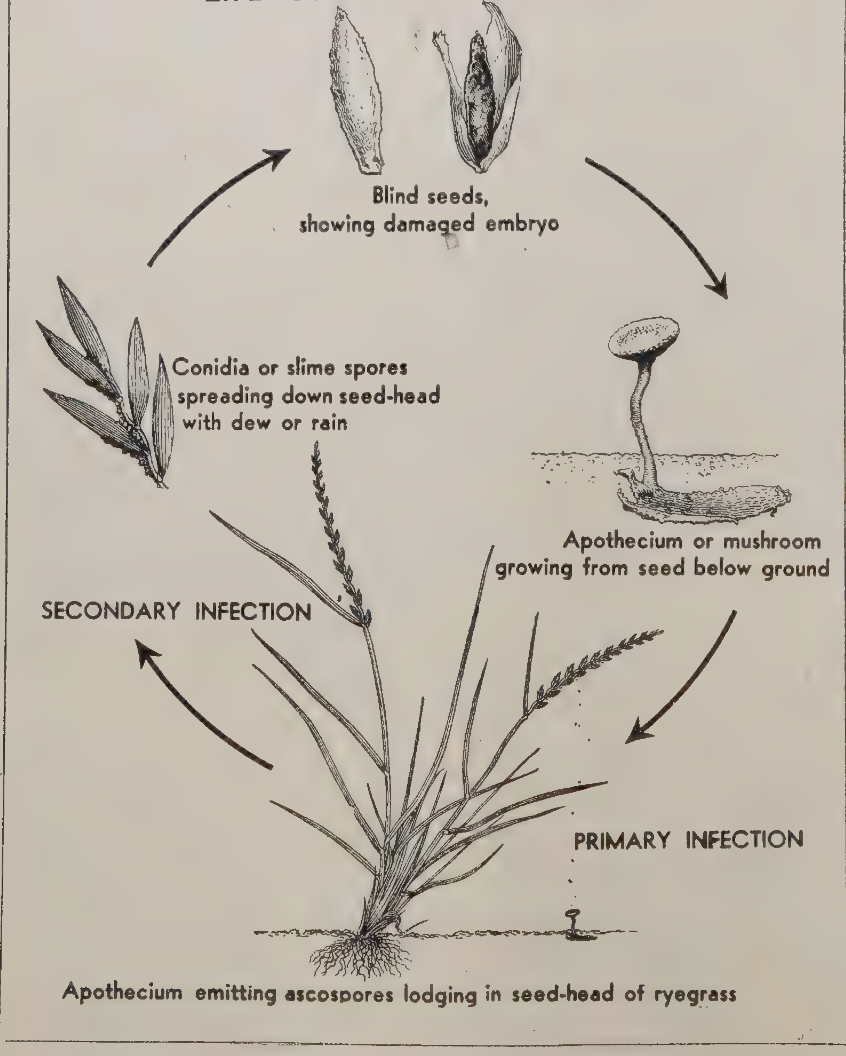
The disease is difficult to detect in the field, but in the laboratory it is possible to obtain a clearer picture of the damage to the seeds. Seeds are peeled of the outer husks and under strong light and magnification are examined for embryo development and signs of the disease. A check can be made by placing peeled seeds in drops of water or staining solution and recording the presence of the slime spores under a microscope.

Pre-harvest Testing

With the spread of blind seed disease throughout the seed-growing districts, and with the great variation in its seasonal incidence, it has become of vital importance to the farmer to know whether areas of ryegrass seed are worth harvesting. By knowing the extent of blind seed infection in his crops the farmer can decide whether to harvest, whether to wait for a white clover crop in preference to the ryegrass, and which crops are the most valuable and should receive his attention first. If given the information in time, the farmer is able to decide whether to make hay of his seed crop or to risk harvesting it.

Therefore, in the pre-harvest testing service for blind seed disease in ryegrass crops the Department of Agriculture gives the farmer a service supplying valuable information and guarding him against financial loss. Very often the grower has to arrange for a contractor's header to complete the harvesting of his paddock, and that cash outlay can be saved if the crop is proved of low germinating capacity and little saleable value. Finally, on the pre-harvest test report the stage of maturity of the sample is given.

LIFE CYCLE OF BLIND SEED



Sending in of Samples

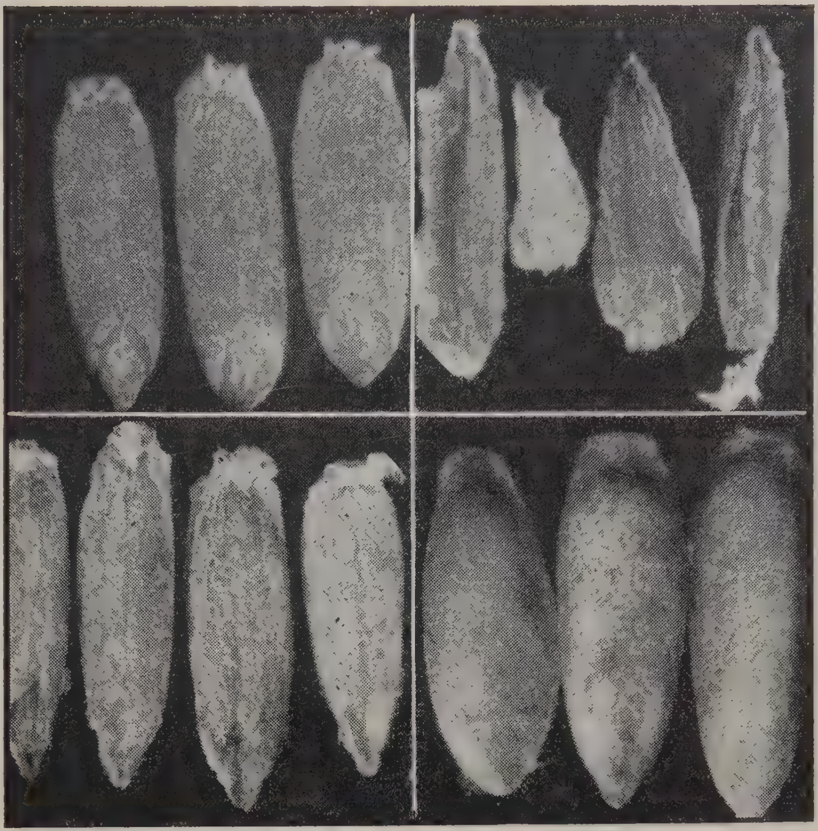
As in the past, the Department of Agriculture will set up stations for the pre-harvest testing of ryegrass seed at Christchurch and Timaru in the coming season to provide a free service for farmers. Care should be taken in the collection of samples for this service. The sample required is about 300 individual heads of ryegrass (a good handful), and it should arrive in as fresh a condition as possible, taken just before mail collection and wrapped carefully in several rolls of newspaper. The collection of the heads needs particular care, as a representative sample is essential for an accurate estimate of the probable germination capacity of the crop. The best method is to walk right across the paddock taking two or three heads at a time and collecting a large bundle from which is selected a fully representative handful to be sent forward. Cut the stalks, tie the bundle with string, and attach a label showing the origin of the sample, preferably the paddock's registered number and letter.

At the testing station at least 100 heads of ryegrass are taken from a sample and one or more seeds on each is examined for the disease, giving a percentage of infection. By adjusting this to the stage of maturity and probable advancement of the disease up to final harvesting, some indication of the probable germination of the seed harvested is possible. The farmer receives the report a day or two later by telephone, telegram, or letter giving him the proportion of diseased seeds, the stage of maturity of the sample, and the probable germination of the crop when harvested if the sample is of a late enough stage of maturity to allow of a reliable estimate.

Accuracy of Estimates

Occasionally these pre-harvest estimates of germination are higher or lower than those obtained on the final purity and germination certificate based on the machine-dressed seed. In such cases many factors may be involved.

First, the sampling may have been at fault and the sample may not have been truly representative; with the secondary infection spread by dew or rain, a handful taken together from one spot may have been heavily diseased, whereas a yard away there might have been a healthy area.



Ryegrass seed with outside paleae removed. Upper left—Healthy seed. Upper right—Diseased seed infected at flowering stage, showing shrunken and diseased condition. Lower left—Diseased seed infected at middle stage of development. Lower right—Diseased seed infected at late stage, showing normal size but red spots on skin of seed.

Secondly, the estimates are reliable within reasonable limits if the cutting and threshing of the seed proceed without much delay; if an infected crop is exposed to prolonged wet weather or heavy dews before or during harvesting, and the drying out of the seed is thereby delayed, the final germination may differ considerably from the estimate. Thirdly, if infection occurs at an early stage and diseased seeds are small and light, they may be lost in dressing, thus giving a higher final germination. Finally it is well established that blind seed disease is not the only cause of low germination in ryegrass seed. Other causes may not be as important, but sprouting of seeds, mechanical injury in threshing or dressing, and excessive heating of seed may all contribute to the loss of vitality and death of seeds.

Where such factors operate the final germination capacity may differ from the estimate given on the pre-harvest test reports, which, however, have been proved in the main reasonably-accurate forecasts.

Factors Concerned in Disease

It is widely recognised that the germinations of ryegrass crops vary widely with the seasons. Present knowledge of the problem points to the following main factors being involved in the fluctuating incidence of the disease:—

1. **Weather conditions,** especially the rainfall between flowering and harvesting, are the principal factor contributing to the spread of the disease. There is a significant correlation between summer rainfall (December-January total) and the average germination of perennial ryegrass seed in South Canterbury. Usually North Island dry-summer areas produce crops of higher germination than the wet-summer areas in the south.
2. **Growth conditions,** which of course are related to the climatic conditions, are another important factor.
3. **Harvest year or age of the stands:** First-harvest areas have a higher germination average than older areas, which may be more particularly the result of their greater vigour and growth.
4. **Harvesting conditions:** Early harvesting under dry conditions with more rapid completion of the task aids the control of the disease.

The relative importance of primary and secondary infections is not yet known, but more light is expected to be shed on this aspect by the intensive study of the problem now being organised.

Previous Research

In 1932 Neill and Hyde, working at Palmerston North, worked out the general history and life cycle of the blind seed fungus and first attributed low germination in perennial ryegrass to this cause. In 1939 they produced a comprehensive account of the problem and in 1943 a further treatise. In their earlier report they described a similar fungus growth that is of no importance in its effect on the seed or germination capacity, but by producing similar mushroom growths can easily be mistaken for the blind seed fungus. This fungus, called Lolium fungus No. 2, produces apothecia on leaf sheaths and dead stalks of ryegrass, whereas the blind seed fungus grows from seeds only. Also in this report is the statement that producing resistant strains is the best method of overcoming the disease problem.

Gorman, also working in Palmerston North in a series of experiments, the results of which were published in 1945, determined yields and germination of ryegrass sown with different types of clovers. In those experiments the lowest germinations were from ryegrass crops sown without clovers and the highest from crops sown with the highest-quality Certified Pedigree white clovers, though the yields of the latter crops were low.

At a meeting of the Blind Seed Committee in Wellington last April reports of research carried out since the previous meeting in 1941 were discussed. Experimental work suggested at the previous meeting had been carried out to the extent permitted under wartime conditions and had followed the following main lines of investigation:

1. Breeding of resistant strains;
2. Control of growth conditions;
3. Use of sprays and dusts;
4. Use of manures;
5. Surveys of the incidence of the disease and factors concerned;
6. Experimental trials to increase knowledge of the disease.

Improving Pedigree Strains

The Grasslands Division of the Department of Scientific and Industrial Research has developed the improved Pedigree strains of perennial, Italian, and short-rotation ryegrass, which are all susceptible to the blind seed fungus. However, Rose and Corkill found that susceptibility to the disease was significantly lower in plants from four Southland old-pasture lines than in plants of the Certified Pedigree strain. They also proved that resistance and

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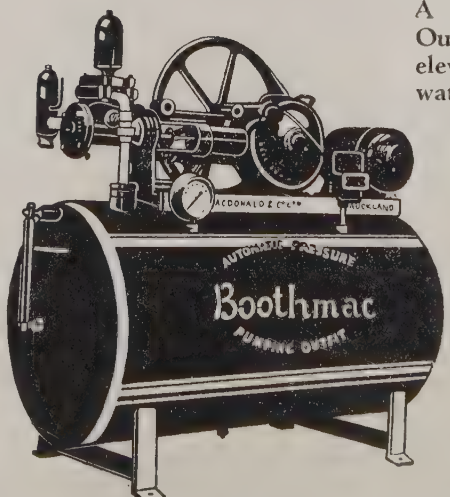

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susceptibility to the disease were inherited and that crosses from resistant plants showed 41.8 per cent. higher germination than the susceptible plant crosses. The resistant plants, however, were greatly inferior to the Certified strains in general production and persistency.

It is hoped to breed a strain with the desirable characteristics of the present Pedigree strain but still having the resistance to blind seed. Such work can be regarded only as long term, and as nothing is yet known of the cause of this resistance it is too early to forecast the final result of this breeding programme. No such comparable research has been carried out with Italian or short-rotation ryegrass, but plans are being prepared for similar investigations in these grasses, in which the lower infection usually experienced in the field is probably the result of later flowering, when the weather is less favourable to the blind seed infection and the shorter period between flowering and ripening.

Trials with sprays and dusts have been carried out at various centres, treating seed before sowing and plants at and after the flowering stage. The usefulness of fungicides still requires further investigation, though colloidal sulphur sprays and copper oxychloride dusting of the plants have given significant and promising increases in germination.

Nitrogenous manures have also given increased yields and germinations when applied at the equivalent rates of 1, 2, or 4cwt. of sulphate of ammonia to the acre. Their value lies in increasing the growth and vigour of the crop.

Examination of seed under magnification. Two fine needles are holding back the husks or paleae, exposing the seed and embryo.

Clean ryegrass seed mixture.

Surveys have been carried out in Hawke's Bay and South Canterbury, and Lincoln College has also been collecting data. Much valuable information has been collected, but the surveys are not yet completed.

Trials to study methods of infection have been laid down by over-sowing paddocks with infected seeds, and results have given further proof that the heavier the crop the higher the germination.

The germination of seed sown bears no significant relationship to the germination of seed harvested, as shown by surveys of seeds of the same origin harvested in different districts. There is, however, correlation between germination percentages and seasonal conditions in individual districts.

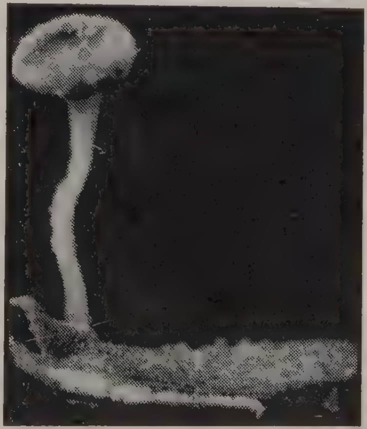
Further research on the time for which the fungus lives in the seed was carried out in 1938. Low-germinating lines from each of the 1936, 1937, and 1938 seasons were tested in the laboratory and in the field. The fungus was still alive in the 1938 and 1937 seed but not in the 1936 seed. It would appear that the fungus lives in the seed for well over a year, but that after longer storage it dies. Sowing old seed therefore might assist in the control of the disease.

Hot water treatment of seed has been found by Northern Ireland workers, Calvert and Muskett, to kill the fungus. Treating seed for 30 minutes in water at 50 degrees C. consistently eliminates infection and, if the treated seed is dried thoroughly immediately after treatment, they report no danger of impaired germination. This treatment is no more than a disease killer and does not improve the germination of the line of seed. The treatment, which needs special equipment and great care, is no guarantee that the subsequent crop will be free from blind seed, as wind-borne spores from headlands or adjacent paddocks may easily infect the crop.

Future Research

Realising the economic importance of this problem, research programmes are being accelerated by the Divisions concerned and will be along the following lines:—

1. Mycological studies are to be continued to determine the significance of the primary and secondary infections and related facts.

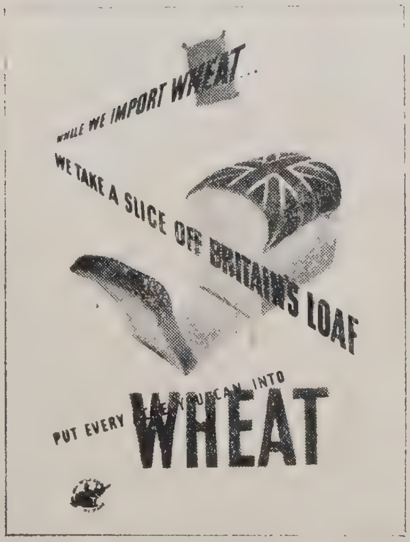


Mushroom growth or apothecium growing from blind ryegrass seed.

2. Breeding programmes for resistant strains of perennial, Italian, and short-rotation ryegrasses are to be continued by the Grasslands Division, Department of Scientific and Industrial Research.

3. Field studies on infections and sampling techniques are to be undertaken by the Seed-testing Station.

4. A Dominion-wide survey is to be carried out by the Fields Division of the Department of Agriculture to cover as many crops as possible, collecting data on crop management, fertilisers, growth conditions, weather conditions, and harvesting conditions, and correlating these with crop yields and final germinations.



5. Widespread field trials are to be carried out by the Department of Agriculture to study intercultivation of crop and depth of sowing, seed treatments, fertilisers, closing dates, bottom growth in crops, grazing management, and sprays and dusts.

Summary

Blind seed disease has taken a very serious toll of New Zealand ryegrass seed crops during the past few difficult seasons. Especially in certain districts it has caused considerable financial loss to farmers, as well as accentuating the high prices of Certified ryegrass seeds. Considerable research work has already been carried out on the problem, knowledge of the disease is increasing, and vigorous research is planned for the future.

At present no definite recommendations can be given for the effective prevention and control of the disease. However, in general it can be stated that the best crops for farmers to save for seed are those from the most vigorous first-harvest areas; the vigour and vitality of those crops will withstand blind seed activity even in a bad year. Any crop or stock management that will increase this vigorous growth—early shutting up, topdressing in spring or autumn, liming, or stimulating dense clover growth and thereby giving the grass more nitrogen—will increase the yield of seed and also probably assist the control of blind seed. There is, however, a danger of overlodging a crop and thus reducing the yield considerably by causing the crop to rot underneath, but only in wet seasons is that likely to occur.

It cannot be too strongly emphasised that during the past few years, because of wet conditions, the disease has been building up to a very dangerous extent. Farmers should therefore consider whether it is not worth while to adjust their seed harvests to avoid this building up as much as possible.

First-harvest areas, if they are vigorous, well-established stands, give the highest germinations. That is indicated in Table III, which shows the average germination capacity as estimated in pre-harvest tests for blind seed disease in 1946-47 season on material of known origin. Ryegrass seed harvested with white clover is usually of low germination during bad seasons, and in the third year of a stand germinations may not be much improved. Dry conditions will greatly upset this build-up of disease, but the past few wet seasons in some districts have made continuous seeding a very risky business.

TABLE III: AVERAGE ESTIMATED GERMINATION CAPACITY AS ASCERTAINED BY PRE-HARVEST TESTS 1946-47 SEASON

Harvest		South Canterbury (per cent.)	Dunedin (per cent.)
First-harvest areas	..	50	79
Second-harvest areas	..	36	46
Third-harvest areas	..	42	31

Farmers are well advised to make use of the pre-harvest testing service. Used effectively it can be of inestimable value. So that surveys and research programmes will be wider and information collected more valuable, farmers are urged to assist by labelling carefully the origin of all samples sent in for testing. If the origin of samples is known, the final germinations of the machine-dressed seed can be checked with the estimates made on the pre-harvest test reports. South Canterbury returns collected last season are now being tabulated, and it is hoped to obtain some valuable and reliable information on the general field management necessary for high germination. The results of this survey will be made available when the final dressing returns have come to hand.

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E. O. C. Hyde: "Ryegrass Seed," "N.Z. Journal of Agriculture," March, 1945.

HAYMAKING HANDBOOK

Hay, which the dairy and cattle farmer relies on largely in the winter for the feeding of his stock, is dealt with in detail in Bulletin No. 290, "Haymaking," the latest bulletin published by the Department of Agriculture. The bulletin, which contains over 40 pages, is copiously illustrated and gives much valuable and practical information.

The major part of the bulletin comprises a comprehensive general study. Following this are four articles on special aspects—"Feeding Hay to Sheep," "Covering Haystacks with Rushes," "Determining Tonnage of Stacked Hay," and "Care of the Mowing Machine."

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WEANING CALVES AND LAMBS

Importance of Grazing Management and Care Against Internal Parasites

BETWEEN 1939 and 1945-46, when the number of sheep in the world decreased by 50,000,000, New Zealand flocks rose in number to 33,975,000, an increase of 2,000,000. However, this gain was offset somewhat by a steady decline in the number of dairy cattle, which fell from 1,828,000 in 1934-35 to 1,683,000 in 1945-46. Therefore, although the Dominion is in a particularly favourable position to increase mutton production, every heifer calf will be needed to build up production of butterfat and so reach the targets set in the primary production programme for aiding Britain. This article by J. C. Gerring, Veterinarian, Hamilton, deals with the grazing management of calves and lambs and the means of lowering disease and mortality rates in the young animals.

THE most expensive period in both food and labour in rearing calves is from birth to weaning. From then on management is the prime factor in maintaining thrift and avoiding losses, and this should aim at evening out seasonal variations in feed supply to obtain an adequate diet throughout the year.

An understanding of the grazing habits of calves is necessary to appreciate the importance of this management factor. Calves are much more selective in their grazing habits than mature animals. Paddocks which are continuously grazed by calves alone soon develop a number of small, closely-grazed areas to which the calves keep returning and a much larger area containing rough feed. This rough feed, which is readily eaten by mature animals, seems to be so unpalatable to calves that they will actually lose weight rather than eat it. Rotational grazing makes provision for this selective grazing habit by providing a constant supply of fresh, palatable feed.

Ruakura Experiments

Work carried out at the Ruakura Animal Research Station illustrates the importance of the management factor on a practical basis. Over a period of seven years trials have been carried out to determine the effect of two widely-different methods of management on the growth rate of calves. For this purpose the calves, mostly Jerseys or Jersey cross animals, have been divided at four weeks of age into two groups. One group has been rotationally grazed for the most part in front of the cows; the other group has been kept in a paddock until the pasture became unsatisfactory before being given a change (so-called set-stocking).

The differences in body weight between the two groups of calves at March 31 in each year are as follows:—

Grazing Management and Growth Rate of Calves (0 to 9 months)

Year	Rotational Grazing Weight lb.	Set-Stocked Weight lb.	Difference lb.
1940/41	416	354	62
1941/42	423	360	63
1942/43	439	374	65
1943/44	385	334	51
1944/45	405	279	126
1945/46	332	262	70
1946/47	424	326	98
1946/47 (twins)	414	341	73

The body weights are taken before the winter begins, that is, usually before any need arises for feeding out hay and silage. In the seven-year period the rotationally-grazed calves were therefore able to enter the winter with between 51 and 126lb. weight more than the calves in the set-stocked group.

That calves rotationally grazed do not tend to develop beef rather than dairy characteristics is shown by the following production results of the two groups:—

	Rotationally Grazed	Set-Stocked	Difference
Total Milk ..	4938lb.	4033lb.	905lb.
Fat	5.7%	5.5%	0.2%
Total Butterfat	279lb.	221lb.	58lb.

The rotationally-grazed animals thus exceeded the production of the set-stocked group by 58lb. of butterfat per animal. All animals were 2-year-olds.

Weaning Lambs

From the management aspect fat lambs can be divided into two main types, the milk lamb, which is sold fat off the mother, and the feeder lamb, which is fattened on grass and fodder crops after weaning.

With the drying off of pastures toward the end of December, particularly in the South Island, suplementary crops must be provided to finish off these feeder lambs. Any check in the growth rate during the weaning period has an adverse influence on carcass quality.

Carcass quality is, in fact, dependent on the rate of growth or live weight gain and rate of maturity. Rate of maturity is a breed characteristic. Thus the Southdown, the earliest maturing of the Down breeds, produces under ideal feed conditions a finished carcass at the lightest weight of any breed. On the other hand, rate of growth is mainly determined by feed.

Growth Rate and Carcass Quality

The three main tissues of the body —bone, muscle, and fat—each develop at a different stage of growth. Bone is the earliest body tissue to develop and fat is the last. A prolonged check at weaning time, producing a store lamb, followed by quick topping off, therefore results in too little muscle or meat development and too much fat, giving an under-fleshed, over-fat carcass.

To produce a high-quality carcass with the maximum of muscle or meat, lambs must be full fed to stimulate maximum growth of the earlier-developing muscle tissue. Continued rapid growth is therefore the basis of meat production.

Feeding Supplementary Crops

Rape is one of the best fattening crops for lambs in areas with a moderately-low summer rainfall. To avoid "rape scald" the crops should be ripe before feeding. Lambs affected with this disease at first show swelling of the ears and head caused by an accumulation of fluid under the skin, and in some cases an area along the midline of the back is affected. Later the skin on affected parts shrivels and peels off.

The feeding value of rape increases markedly after ripening. Recent investigations in Canterbury suggest that this higher feed value is associated with an increase in the fibre content which takes place as the plant becomes more mature. That would explain why an apparently-poor crop which ripens quickly gives better results than one which grows rapidly, but is slow to mature. Because of this more rapid growth, rape is in general unsuitable for heavier-rainfall areas such as the Auckland district. On a dry matter basis the nutritive value of fully-mature rape compares favourably with such concentrates as oats and barley; it is also readily eaten. Lambs should not be weaned directly on to rape, but should be given a few days on pasture, a feed to which they are accustomed, and then gradually introduced to the crop.

Experiments carried out by the Department of Agriculture in Canterbury indicate that, except in wet summers producing a fair growth of pasture,

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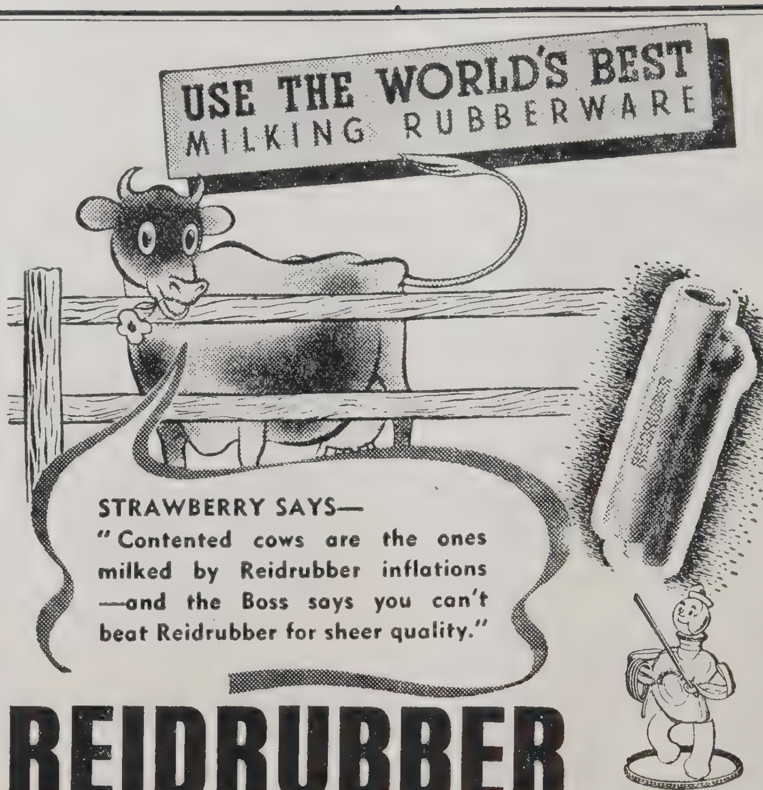
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rape-fed lambs fatten faster without a run-off or other supplementary feed.

Sweet Blue Lupins

To determine the suitability of sweet blue lupins for fattening lambs, experiments were undertaken by Lincoln College in the autumn of 1941. In feed value sweet blue lupins are equal to rape if feeding is begun just before the flowering stage. Though lambs will eat the flowers and green pods, when feeding is delayed until this stage of the plant's growth the stems are less readily eaten. For the initial grazing the crop produces more feed per acre than rape, but the second growth provided by rape probably offsets this advantage.

Sweet blue lupins are increasing in popularity on some of the lighter soils of the South Auckland district. The same grazing management as for rape is recommended.

Losses from Internal Parasites

It is important to remember that all animals harbour worms. Eradication, therefore, as far as present knowledge goes is quite out of the question. It is only when the number of worms infecting the animal becomes excessive that a diseased state is set up. In fact, a moderate infestation is now thought to play an essential part in building up an animal's resistance to worms. This resistance or immunity is built up gradually over a fairly long period, so that young animals of all species are always more susceptible to worms than adults. Good feeding can increase considerably this resistance, and starvation can quickly break it down even in adult animals.

Common Worms

Fortunately, the different types of worms causing most trouble in New Zealand have essentially the same life history, and a system of management applicable to all of them can be devised to minimise losses.

Mature male and female worms infest the animal's body internally, and the eggs laid by the female pass out in the animal's droppings on to the grass. In warm, moist climatic conditions the eggs hatch out, producing minute larvae (immature worms) which go through various stages of development until they reach what is known as the infective stage. Infective-stage larvae crawl up the blades of grass, and when swallowed by the grazing animal develop into mature worms, which in their turn start laying eggs, so completing the life cycle.

The minimum time from the passing of the egg in the animal's droppings to the development of the infective-stage larva is a week. Therefore the longer animals stay in any one paddock for more than a week the greater is the danger of an excessive infestation with worms.

It has been found that a heavily-infested pasture grazed by lambs showing no outward signs of worms contains about 400 worm larvae per pound of grass. Animals eating 20lb. of grass daily may therefore swallow up to 8000 larvae. In young animals possessing little immunity to worms most of these 8000 larvae develop to the mature stage within three weeks. Under such conditions lambs which are apparently healthy may pass out in their droppings as many as 8,000,000 eggs daily, which clearly indicates how quickly pastures can become infected in a permanent grassland system of farming such as that in New Zealand.

Excessive Infestations

Warm, moist climatic conditions favour the development of the infective-stage larvae and tend to increase the worm infestation of the grazing animal. Though a few larvae may survive for long periods, up to two years for some species, the majority die out within a few weeks. Unhatched eggs constitute the most resistant stage, so that a prolonged drought followed by warm, showery weather may produce a mass hatching and a likelihood of heavy infestations.

Length of pasture has several effects. When the number of larvae on a pasture remains constant the shorter the grass the greater will be the concentration of larvae, and this, together with the resultant widespread grazing, means a bigger intake of larvae by the animal. To a slight extent this is offset by the greater drying effect of the sun and wind, which is unfavourable to larval development. The most important effect is on the animal's level of feeding and therefore its resistance to worm infestation. Consequently, close grazing for the most part favours excessive infestation.

Overstocking with young, susceptible animals alone must be regarded as a dangerous practice. Thrifty adult animals possess a high resistance to worms, most of the larvae they pick up being destroyed inside them. Under intensive-farming conditions the grazing of adult and young stock together will thus reduce considerably the danger of excessive infestation.

Resistance to Worms

The trials at Ruakura to demonstrate the effect of rotational grazing and set-stocking on the growth rate of calves when continued through the winter to the yearling stage gave a most striking illustration of the part played by feeding in increasing the animal's resistance to worm infestation.

Set-stocked calves which entered the winter with a deficiency in weight of 60lb. suffered losses from worms ranging from 5 to 50 per cent., despite routine drenching. At the yearling stage the weight deficiency of those that did survive had increased to 140lb. Deaths would have been much higher without treatment. Rotationally-grazed calves were never drenched, and although they suffered almost the same degree of worm infestation, as determined by the number of worm eggs passed out in the droppings, there were no deaths.

Symptoms of Worm Infection

Lung worm infection sometimes causes severe losses in calves, young animals from two to six months of age being particularly susceptible. It is quite distinct from the type affecting sheep, which is of little importance, and no cross-infection between the two animals can occur.

Infection is characterised by a dry, husky cough. Depending on the severity of the infection, coughing may be slight and infrequent with little effect on the animal's condition, or fits of violent coughing may occur accompanied by rapid and laboured breathing. Pneumonia is a frequent complication, followed by marked loss in condition, and in very acute cases death may occur within a few days. In more chronic cases the calves remain unthrifty, and coughing may continue for several months.

Post-mortem examinations have revealed mature worms up to 3½in. long in the smaller branches of the windpipe. Dark, solid areas indicating pneumonia are usually present in the lungs.

Treatment consists in removing the calves immediately from the infected paddock, preferably to one that is well drained, and improving the animal's condition by better feeding. No drug is available which is effective against lung worms. As infection with stomach and bowel worms is almost always present at the same time, drenching with phenothiazine should be carried out to rid the animal of these worms.

Different types of worms infest the fourth stomach and small intestine, some being more important than others. Owing to the similarity in their life history most types are present at the same time in an animal, so that the symptoms are caused for the most part by their combined infestation. Unthriftiness is the most constant and characteristic symptom of worm infestation. This is soon followed by scouring and progressive loss in condition.

During a wet summer the large stomach worm is likely to cause most trouble. It occurs in the fourth stomach and is about 1in. long. As it is a blood-sucking worm, anaemia is the most prominent symptom, and is indicated by paleness of the lining membranes of the eyelids, the mouth, and the skin. Soft, dropsical swellings involving the under-jaw frequently occur, and sometimes the lips are swollen. In exceptional cases infestation may be so severe as to cause death before any marked loss of condition.

The small bowel worm is responsible for most losses in calves and lambs, especially during the winter months. It occurs mainly in the first 20ft. of the small bowel. Owing to its small size, ⅛in. to ¼in. long, it is often difficult to see even when present in very large numbers. Heavy infections most commonly produce scouring, resulting in marked thirst and rapid loss in condition. Though affected animals continue feeding, they gradually become too weak to stand, and finally die without struggling. Usually several animals begin showing symptoms of worm infestation at the same time.

Treatment with phenothiazine is effective against most of the bowel worms in sheep and calves. This drug is marketed under several different trade names, most of them beginning with the prefix phen. Full instructions are given on the containers in which the drug is sold.

It is important to remove animals from the infected paddock, to treat all of them, to give full dose rates, and when they are severely infected to repeat the treatment in 10 to 14 days.

To prevent stock losses from worms the farmer should:—

1. Practise rotational grazing, avoiding intervals of more than a week in any one paddock. If possible, spell a grazed paddock from young animals for three weeks.

2. Use thrifty adult animals, cattle, horses, or sheep to clean up the infective larvae on the grass and so make the paddocks safer for the young, susceptible animals.

3. Treat lambs at weaning, then move them on to clean pastures or forage crops. In wet seasons feed crops off in breaks and avoid allowing the lambs back on to old breaks.

4. Avoid overstocking. During short periods where this is not possible graze young and adult animals together rather than keep all young, susceptible animals separated from the older animals.

5. Build up the young animals' resistance by better feeding and management methods.

Temporary Blindness in Calves

In a small percentage of cases temporary blindness occurs in calves after drenching with phenothiazine. It is caused by the breakdown products of the drug sensitising the tissues of the eye to the rays of the sun.

The first symptoms are excess production of tears, which run down the face 12 to 36 hours after drenching. Later a general cloudiness develops over the cornea, the glistening transparent membrane covering the surface of the eye, and the animal shows symptoms of blindness. Recovery usually occurs within 10 days after drenching. In a few cases this takes place more slowly over a period of several months, during which the cloudiness becomes more dense, and at the same time the area involved shrinks to a small spot on the outer aspect of the eye.

To prevent this trouble calves should be examined the day after dosing. If excess tears are noticed running down the face of any calf, the whole mob should immediately be placed out of direct sunlight, either indoors or in a shelter plantation for the remainder of that day. Thirty-six hours after drenching there is little, if any, danger from this trouble. Only a very small number of calves treated with phenothiazine develop temporary blindness.

◆

Flock House Trainees Acquire

LAMB DOCKING EFFICIENCY

THE breeding flock of 6000 ewes at the Department of Agriculture's Flock House Farm of Instruction, Bulls, provides an excellent opportunity for trainees to be taught lamb docking.

BEFORE docking of the lambs at the station was begun in early September trainees were given lectures in the theory of lamb docking, including hygiene; siting, layout, and erection of various types of yards; methods of docking; the importance of correct and careful earmarking; the theory of age marking, and other factors important in the successful docking of lambs.

To ensure that all trainees participated equally during docking operations a roster was drawn up; the six trainees detailed off daily for docking tuition assisted in erecting the yards from paddock to paddock, and then alternately throughout that day caught and held or docked lambs.

Every trainee was shown how to hold lambs and then instructed in the use of both knife and emasculator. After this initial instruction trainees docked lambs under the supervision of an instructor, who corrected any faults and saw that the operations were efficiently carried out.

In a remarkably short time every trainee became proficient and could undertake the whole job, and trainees assisted materially throughout the whole docking. Unfortunately, as lamb docking is seasonal, trainees have only the one opportunity to learn this phase of farm operations, but experience at the station this season shows that any trainee could if necessary dock lambs efficiently if not quickly. Rapidity in docking comes only with practice.

—*J. H. HITCHCOCK,*
Assistant Farm Manager,
Flock House Farm of Instruction.

Trainees at Flock House docking lambs.

Suitable Wear Adds to Pleasure and Efficiency of Beekeeping

By R. S. WALSH, *Apiary Instructor, Auckland.*

MUCH unnecessary aggravation of bee colonies and stinging can be attributed to the wearing of unsuitable apparel when working in the apiary. The smooth, unhurried, yet efficient manipulation of colonies so necessary if the maximum effort is to be obtained from the bees with the minimum interruption to the organisation of the hive cannot be achieved if the beekeeper is subjected to excessive stinging. Suitable clothing and equipment will do much to ensure that apiary work is done with a minimum of discomfort both to the beekeeper and the bees.

BEES are susceptible to certain odours, to various colours, and to some materials and textures.

Unsuitable Clothing

Part-time farmer-beekeepers should not enter the apiary while clad in milk-stained denims, as such attire arouses in the bees a sense of hostility. The smell of stale milk, the odour of cows, the colour of the denims, and the material from which they are made are individually abhorrent to bees, and in combination they arouse them to a condition of frenzy.

Black and dark blue clothing should not be worn in the apiary. To wear a woollen pullover is to risk upsetting the bees, as their legs become entangled in the material and in their endeavours to extricate themselves the bees become extremely vicious and do their utmost to sting. Woollen socks, for the same reason, encourage attacks about the legs and ankles. If the socks are really heavy, the beekeeper has a measure of protection, as the bees' stings are too short to penetrate them. Bees becoming entangled in the fabric of grey socks, which are not normally obnoxious to the bees, may be provoked into stinging. Brown socks, however, should be avoided, as bees will deliberately attack them, possibly because of their colour and animal fat in the wool.

Disagreeable Odours

It is not advisable for the apiarist to open hives after he has been painting, as the smell of paint on the hands or clothing annoys the bees. Unnecessary crushing of bees during manipulation should also be avoided, as the odour of crushed bees starts other bees stinging, and the smell of the stings provokes yet further stinging, which slows up the work of the apiarist and deprives him of much of the pleasure associated with beekeeping. It is advisable always to have a pail of water in the apiary so that the hands and hive tool can be washed when necessary to cleanse them of honey and the odour of stings.

Bee Veils

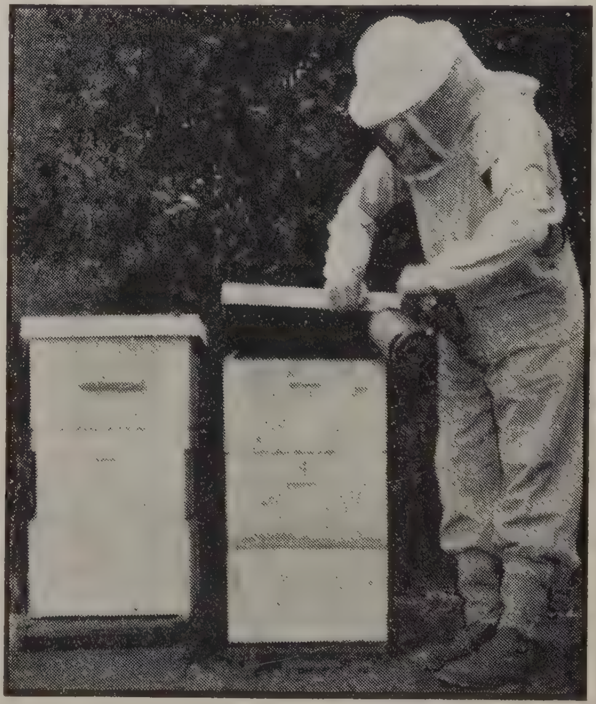
Cloth bee veils should be washed regularly, as an unclean veil is very distasteful to the bees and will cause them to buzz around the face and neck in a most annoying manner. Clothing also should be rinsed out after a day in the apiary.

Bee veils made of mosquito netting should have a square inset of sufficient black material to cover the face to assist vision. Though an all-black veil places little strain on the eyesight, it is a source of annoyance to the bees even when perfectly clean. On the other hand, an all-white veil will not annoy the bees, but it is very difficult to see through and cannot be worn continuously, as the eyesight would be adversely affected and observation of detail is impossible. A disadvantage of all cloth bee veils is their tendency to blow against the face and neck during windy weather, and render those parts liable to unnecessary stinging. The wire gauze veil is undoubtedly the best form of protection. The confidence engendered in the apiarist by protection from stings, especially about the face, has a high psychological value in overcoming nervousness with bees.

The ideal wear for work among bees is well-washed white linen or twill; khaki drill is also very suitable and is more serviceable. A practical outfit donned with the minimum of trouble is a white or khaki shirt with khaki bib overalls. Although worn extensively, felt hats are not the best type of headgear for the apiarist, as their tendency to make the head perspire and the annoyance of felt material to the bees cause excessive stinging, as the number of stings embedded in the hat-band and crown will verify. The scent of the stings becomes impregnated in the material and is a constant source of annoyance to the bees. A stiff panama is much cooler and lighter and will give every satisfaction when cloth veils are worn. but is not rigid enough to support the wire gauze veil. A cork or fibre sun helmet is undoubtedly the nearest approach to the ideal and can be used with any kind of veil. It is extremely comfortable to wear, as lightness is combined with ample provision for ventilation. The sun helmet is covered with either white or khaki drill, colours eminently suitable for apiary work.

Gloves and Cuffs

Beekeepers who find difficulty in becoming immunised to bee stings would be wise to wear bee gloves



Wearing sun helmet, wire gauze veil, white shirt, bib overalls, cuffs, and anklets this beekeeper is well equipped to handle apiary work with the minimum of discomfort to himself and the bees.

SUITABLE WEAR IN THE APIARY . . .

until they gain sufficient confidence to discard them, though gloves are an impediment to efficient manipulation of colonies, and the "touch" that is developed by experienced beekeepers cannot be acquired unless the hands are uncovered. If there should be in the apiary a diseased colony of which the beekeeper is unaware, gloves may be the means of spreading the infection.

A pair of cuffs made of white calico or light canvàs with elastic at wrists and elbows are all the protection that should normally be required.

Ankle Protection

Some beekeepers tuck their trousers or overalls into their socks to prevent the bees crawling up their legs, but it is better to wear more adequate protection. Boots should always be worn in the apiary to protect the ankles, and short puttees will prevent the bees entering the tops of the boots or travelling up the trouser legs. If the legs of the overalls are lengthened by four or five inches, they can be held tightly against the boot tops with a strap specially constructed to loop over the toe of the boot and circle the instep, where two additional straps lead from the top centre of the loop to buckle behind the ankles. Numbers of beekeepers now wear army anklets in the apiary, and if a tight-fitting pair can be procured they will give fairly satisfactory protection.

PEDIGREE SOW RECORDS

Contributed by the Livestock Division.

DURING the seven months April-October, 1947, 34 of the 42 litters of pigs recorded were sufficiently good to be included in one of the five grades set out below:

Grade	Minimum Litter Weight	
	At 3 weeks.	At 8 weeks.
1	120 lb.	360 lb.
2	100 ,,	300 ,,
3	90 ,,	270 ,,
4	80 ,,	240 ,,
5	70 ,,	210 ,,

Breed Averages for the Period

Breed.	No. of Litters Recorded	Litter Weight at		Number of Pigs.		Average Weight at	
		3 weeks (lb.)	8 weeks (lb.)	Born.	Weaned.	3 weeks (lb.)	8 weeks (lb.)
Berkshire	26	99	266	8.7	7.2	13.70	37.00
Large White	13	130	370	11.1	9.4	13.90	39.50
Tamworth	3	90	266	9.3	7.0	12.95	38.00

A No. 3 grade litter is regarded as a good performance, No. 2 as excellent, and No. 1 as special.

The following list gives the names and addresses of the breeders of recorded sows and details of the litters:

Owner's Name and Address.	Herd Book Number of—		Litter Weight at		No. of Pigs.		Grade of Litter.
	Sire.	Sow.	3 weeks (lb.)	8 weeks (lb.)	Born.	Weaned.	
Berkshire							
Cook, P. D., Matai, Ahaura, West Coast	21241	20166	91	223	9	6	5
Rowlands, T. E., Ruthin, R.D. Kaiapoi	21227	19994	79	255	8	6	5
Rowlands, T. E., Ruthin, R.D. Kaiapoi	21227	21465	67	227	8	6	—
Major, C. A., Turakina	14085	20254	142	530	11	11	1
Cowan, G. T., Rotomanu, Westland	21917	20894	158	403	11	10	1
Cowan, G. T., Rotomanu, Westland	21917	18371	86	231	11	6	5
Hodgkinson, H. E., Rotomanu, Westland	18295	18278	67	230	9	6	—
Ayson, W. R., Aparima, R.D. Otautau	22111	22147	110	282	10	9	3
Pitcaithly, R., Box 67, Eltham	22622	22097	104	240	9	8	4
Pitcaithly, R., Box 67, Eltham	22094	21279	95	128	9	6	—
Jackson, K. W., Mountain Road, Inglewood	19583	20477	80	201	11	7	—
Unwin, S., Winchester	19666	19996	121	270	10	9	3
Larsen, O. C., R.D. Aorangi	21107	22324	85	264	6	6	4
Larsen, O. C., R.D. Aorangi	22414	22176	117	338	7	7	2
Larsen, O. C., R.D. Aorangi	22146	22156	92	262	7	7	4
Larsen, O. C., R.D. Aorangi	22414	21264	82	230	5	5	5
Larsen, O. C., R.D. Aorangi	22145	20572	124	287	9	8	3
Larsen, O. C., R.D. Aorangi	22145	22411	62	131	6	5	—
Larsen, O. C., R.D. Aorangi	22145	20566	69	171	5	5	—
Briggs, B., Seddonville, Nelson	21368	19892	84	259	10	6	4
Davies, F. D., Buckland Road, Tuakau	22289	20613	103	260	13	9	4
Ellerm, O. C., Sanson, R.D. Palmerston North	22745	21789	150	504	10	9	1
Ellerm, O. C., Sanson, R.D. Palmerston North	22745	22551	74	155	6	5	—
Ellerm, O. C., Sanson, R.D. Palmerston North	22745	22550	105	289	8	8	3
Hodgkinson, H. E., Rotomanu, Westland	18295	20718	135	331	8	8	2
Bain and Son, J., Seddonville	21836	20492	92	229	11	9	5
Large White							
Haydon, G. C., Barrytown, P.B. Greymouth	6129	6410	130	433	15	9	1
Haydon, G. C., Barrytown, P.B. Greymouth	5671	6354	141	389	12	11	1
Haydon, G. C., Barrytown, P.B. Greymouth	6129	6410	116	319	11	8	2
Haydon, G. C., Barrytown, P.B. Greymouth	6129	6484	154	263	10	8	4
Rowlands, T. E., Ruthin, R.D. Kaiapoi (Berkshire)	21227*	6645	127	379	9	8	1
Richards, A. T., P.B. Coast Road, Greymouth	5671	6001	91	284	13	7	3
Spackman, L. S., R.S.A. Buildings, High Street, Auckland	6217	6344	125	425	11	10	1
Anderson, C. B., Bulls, Marton R.D.	6829	6510	106	265	11	10	4
Anderson, C. B., Bulls, Marton R.D.	6829	6827	105	230	8	8	5
Anderson, C. B., Bulls, Marton R.D.	6829	6826	102	268	9	9	4
Anderson, C. B., Bulls, Marton R.D.	6829	6828	95	269	9	9	4
Montgomerie and Bell, Ardmore, Papakura	6956	6689	195	639	13	12	1
Montgomerie and Bell, Ardmore, Papakura	6144	6612	213	658	14	13	1
Tamworth							
Moore, W. F., Maheno	14214	14803	139	467	11	10	1
Kaikoura Pig Club (secretary, R. R. McRae, Tullock Mains, Kaikoura)	14996	14276	85	221	8	7	5
Levin Pig Club (secretary, B. Bartholomew, P.O. Box 14, Levin)	14871	14020	47	110	9	4	—

* Berkshire cross.

RAISING DUCKS AS LAYERS AND TABLE BIRDS

By F. C. BOBBY, *Superintendent of Poultry Husbandry, Wellington.*

A GENERAL summary of practical duck raising is to be the subject of articles in the "Journal" over the next few months, but not with the intention of encouraging any increase in the duck flocks of New Zealand. This is not because of the present shortage of poultry foods, but because the consumption rate of duck eggs in New Zealand is limited, even in times of acute egg shortages, as at present, and any sudden and appreciable expansion in flocks of ducks would result in marketing difficulties during the egg "flush" season in the spring and early summer.

PRICES returned for duck eggs tend to be slightly lower than those for hen eggs, and any rapid increase in supplies would probably result in even lower returns to duck farmers. This does not mean that there is no place for duck egg production in the economy of the poultry industry, but rather that care must be taken not to increase duck flocks until the consumption rate of duck eggs increases. Thus any appreciable expansion in duck raising at present might easily lead to an adverse reaction upon established duck farmers with flocks on a commercial scale.

The following figures show the numbers of ducks and poultry in New Zealand in 1945:—

	Poultry	Ducks
North Island	2,516,305	252,790
South Island	1,554,368	67,128
Dominion totals	4,070,673	319,918

These figures refer to both sexes. The greater proportion of ducks is in the North Island, and the greatest concentration of these flocks is around Auckland, where there are large commercial farms.

The limited demand for duck eggs is caused largely by public prejudice against them, which is not confined to New Zealand, but was evident in Great Britain before the war. It is unfortunate that duck eggs cannot be preserved by the housewife as satisfactorily as hen eggs, and that up to the present duck egg pulp has not been readily accepted by pastrycooks and others using egg pulp for manufacturing. There seems little reason for the prejudice against duck egg pulp, and in the future it may largely disappear.

[*Sparrow Industrial Pictures Ltd. photo.*

Public alarm after an occasional reported case of illness after eating duck eggs has not assisted the position, though there is no danger in eating duck eggs which have been properly cooked, whether by boiling, frying, or poaching, or when included in any food mixture which is subsequently cooked in the ordinary way. Trouble has been experienced only in a very limited number of cases, and then only when duck eggs have been eaten in a raw or semi-raw state, as in the case of Spanish cream made with duck eggs. The trouble which has occurred should therefore be understood and kept strictly in perspective, since any possible recurrence can be avoided so easily.

Duck Raising

Ducks, like poultry, are raised either for egg production or table duck production. The rearing and management of ducks for both purposes are similar in a number of respects.

The best results with laying ducks are generally obtained where the birds have ample ground, and particularly where free range is possible. Ducks cannot therefore be generally recommended for small poultry keepers with strictly-limited areas of ground, though ducks raised for table purposes require to be kept on smaller areas during the fattening period.

A creek or running water is not essential for laying ducks, but is of some advantage for breeding ducks, though it is still not essential. Ducks do well running over grass paddocks or in an orchard, but a well-drained soil should be selected where possible. Ducks should not be run in confined spaces on heavy soils. Though laying ducks on free range and with access to a creek may pick up some food of value, the feeding of adequate quantities of mash and grain is essential if high egg production is to be obtained and maintained.

The capital outlay for the establishment of a duck farm on a commercial scale is appreciably lower than for a poultry farm of equal size.

Breeds of Ducks

Breeds of ducks most commonly met with in New Zealand are Khaki Campbell, Fawn and White Runner, Pekin, and Muscovy. Those requiring greater details of breeds than are given here may refer to the New Zealand Utility Poultry Standards or accepted standard text-books on the subject.

Khaki Campbell. This is by far the most popular egg-producing breed, and as the quality and flavour of the flesh are good, surplus drakes and culls may be used for table purposes. The Khaki Campbell has been developed as a high-producing laying duck, and flock averages of 200 or more eggs per bird per annum are not uncommon where a good strain of this breed is kept and management is efficient. Ducks of this breed lay a white egg The general colour of the duck is khaki, and the drake is bronze or bronze-green in the head, neck, and stern. The minimum weights laid down for this breed in the New Zealand Utility Poultry Standards are:—

Ducks under 12 months ..	5lb.
Ducks over 12 months ..	6lb.
Drakes under 12 months ..	6lb.
Drakes over 12 months ..	7lb.

These may seem high weights for heavy laying strains, but recent experience under the New Zealand Poultry Flock Improvement Plan indicates that they are easily attained among flocks of good Khaki Campbells.

Fawn and White Runner. The Runner breed of ducks are essentially egg-producers, being of a much lighter build than Khaki Campbells. Runner ducks are not suitable as table birds, and accordingly have not the same general utility value. Runner ducks are excellent layers and until the development of the Khaki Campbell were unrivalled in this respect. Today Runners in any variety are not as popular as the Khaki Campbell. They lay a green or greenish-white egg. The minimum standard weights for the breed are as follows:—

Ducks under 12 months ..	3lb.
Ducks over 12 months ..	4lb.
Drakes under 12 months ..	3½lb.
Drakes over 12 months ..	5lb.

[*Sparrow Industrial Pictures Ltd. photo.*

Muscovy ducks are a dual-purpose breed, the ducks laying well and the drakes being used extensively for table purposes.

Pekin. The Pekin, primarily a table duck, matures quickly and carries a good quantity and quality of breast meat. It will, however, lay well, particularly in strains which have been developed for egg production, but it cannot be compared with the Khaki Campbell for egg production. The plumage of both sexes is cream and the bill yellow. Good drakes attain 8lb. or over and ducks a pound less.

[*Sparrow Industrial Pictures Ltd. photo.*

The Pekin duck is primarily a table bird, but will lay well.

Muscovy. This breed may well be termed a dual-purpose breed, as Muscovy ducks lay moderately well and drakes are used extensively in this country for table purposes. Unlike other domesticated ducks, birds of the Muscovy breed are able to fly easily. The drake is considerably larger than the duck, there being a greater difference in this respect than in other breeds of ducks. There are two varieties of this breed, the coloured and the white.

Housing Ducks

The amount of protection afforded to laying ducks depends to a large extent on the part of New Zealand in which they are kept. It is not uncommon in northern districts for no housing at all to be provided for flocks of laying ducks, which are retained in a closed grass pen at night and sit about in the grass all night during both summer and winter. In districts where hard frosts and snow may be expected it is preferable to give ducks protection at night during the winter in a simple, open-fronted, lean-to type of house. Irrespective of district and whether special housing is supplied, it is essential to provide ducks with some form of wind-breaks which will afford them adequate protection against ground wind. These do not need to be elaborate, but should be effective protection against the prevailing wind. In addition, it is desirable to afford ducks some shade and not expose them continuously to hot midday summer sun. If natural shelter is not available, some simple combination of wind and sun shelter is highly desirable.

In addition to housing for adult birds, a simple type of brooder house is necessary, which will vary according to the system of rearing employed. As the brooding period for ducks is considerably shorter than that for chickens, the capacity of brooder house and brooder equipment necessary is less than that required in chicken raising. No special housing is required during the growing stages, but on a commercial duck farm provision has to be made for an incubator room, food store, and egg room.

(The next article will deal with breeding, incubation, and rearing.)

Sweet Peas, the Queen of Annuals

SWEET PEAS of unsurpassed quality can be grown in New Zealand for garden display, cut flowers, or exhibition by paying attention to the details of their cultivation described in this article for the home gardener by J. P. Hudson, Horticulturist, Wellington.

[Photo News Ltd. photo.

ALTHOUGH the sweet pea grows to perfection in New Zealand and is fully appreciated as a flower for cutting and garden decoration in summer, it does not have the popularity as a winter flower that it enjoys in America and Europe, where it is grown on a very large commercial scale and is demanded all the year round by florists.

Sweet pea growing under glass has become quite a large industry overseas, as winter and spring blossoms can be grown only with the protection of a greenhouse, and even then painstaking attention has to be paid to every detail of their culture if large, well-flowered spikes are to be produced. Relatively few out-of-season sweet peas are now produced under glass in New Zealand on a commercial scale, although the crop can be grown here quite successfully.

The large, beautifully-formed flowers of modern varieties, borne in fours on straight strong stems 18in. or more long, bear little resemblance to the wild flower from which they originated. The wild pea of the Mediterranean (*Lathyrus odoratus*), remembered by men who served in Sicily as a climbing weed with fragrant reddish purple flowers, borne in pairs, was introduced into Holland and England in 1699, but became popular only during the early nineteenth century. From about 1880 many famous breeders, especially Thomas Laxton, Henry Eckford, and James Carter, began to introduce outstanding new varieties as a result of deliberate hybridising work, but the outstanding sweet pea "date" is 1904, less than 50 years ago, when the variety Countess Spencer appeared and introduced the modern type of flower with its beautifully-waved standard, fully-expanded wings, and extended and straightened keel (see diagram on page 613).

Although so greatly improved, present-day sweet peas are by no means perfect and there is ample room for improvement, as will be shown later. There is no reason why these desirable improvements should not be introduced by observant and interested home gardeners, just as the so-called winter-flowering type, used universally by commercial glasshouse growers overseas, was introduced in 1889 by the wife of a quarryman in northern New York, who worked on the type for 25 years before it finally passed into commerce.

Root Nodules and Tendrils

Sweet peas are annuals which show one or two botanical features of interest to home gardeners. The first is that their roots, like those of other members of the pea and bean family (natural order *Leguminosae*), develop small cream-coloured warts (nodules) inhabited by a special type of bacterium (*Bacillus radicicola*) which normally lives in the soil but will invade the roots of any leguminous plants that happen to grow in its neighbourhood. Although the nodules look as though they might be some disease, they are actually very beneficial, as the bacteria have the ability to collect nitrogen from the air in the soil and pass it to the sweet pea roots in a form in which they can use it. The transaction is not altogether one-sided, as the sweet pea in return supplies the bacteria with sugar, and these two strangely-dissimilar plants can thus be said to be working in an amicable partnership (symbiosis) from which they both derive direct benefit.

From a gardening point of view the importance of this partnership is that peas, beans, etc., rarely respond to nitrogenous manures, as they already have their own method of obtaining sufficient nitrogen through the agency of the nodule bacteria. Heavy dressings of nitrogenous fertilisers are therefore only wasted on sweet peas, although a light application of some quick-acting form of nitrogen such as nitrate of soda may sometimes be advantageous in early spring to stimulate the plants into growth at a time when the soil is still too cold for the nodule bacteria to be very active.

Another feature of the plant is the way in which it climbs by means of tendrils, which support its weight and so make it unnecessary for the sweet pea to produce a hard, strong, woody stem. The tendrils are, in fact, parts of the leaves, which have developed the ability to wind round solid objects, anchor themselves securely, and then pull the plant up and hold it firmly in a position where it can get light and air. Unfortunately, tendrils are apt to grasp flower stems, bending or distorting them, and the gardener who is anxious to produce flowers with long, straight stems for show work or cutting must remove the tendrils. This, of course, leaves the plants "with no visible means of support," and they must therefore be staked by one of the systems described in detail later.

Situation

The ideal situation for sweet pea growing is a sunny, open place protected to some extent from the prevailing winds by some form of shelter which does not cast a shade over the plants, yet not in any way shut in. Good sweet peas cannot be grown in draughty, shaded places, behind trees, or close to buildings or fences, because in such situations it is almost impossible to keep them free from mildew and the flower buds show a tendency to drop off. Rows of sweet peas are best running north to south

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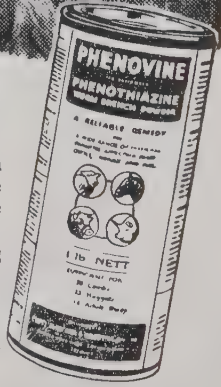
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in an open situation where they get all the sun.

Sweet peas are hardy and will stand quite severe frosts, but the earliest flowers are, of course, produced in the milder, frost-free districts.

Soil

Almost any type of soil can be used with reasonable success for sweet pea growing, provided it does not become waterlogged for prolonged spells after heavy rain. As with most plants, however, the best results are obtained in deep, fertile loam, and less favourable types of soil should be carefully prepared to make them more suitable for sweet pea growing.

It is wise not to grow most plants on the same site more than once or twice in succession, but sweet peas are fairly tolerant in this respect and are often grown successfully in the same place season after season for many years. If the previous year's plants were unsatisfactory, however, and especially if they died off prematurely or the roots showed signs of disease, it is wise either to change the soil or to grow sweet peas elsewhere for two or three years.

The traditional method of preparing the ground for sweet pea growing is to take out a trench 2 to 3ft. wide, digging out the topsoil to a depth of 10in. and putting it to one side of the trench. The next spit 10in. deep is then dug out and put in a mound on the other side to keep it separate from the topsoil. A layer of farmyard manure, compost, fowl manure, strawy litter, stack bottom, leaves, household scraps, or any other form of organic matter is then forked into the soil at the bottom of the trench.

The bottom of the trench should next be trodden firmly, provided the soil is not too wet for this to be done without making it muddy, after which the soil from the second spit should be returned to the trench, mixing with it further supplies of the organic material referred to above. This layer of soil should, in turn, be trodden firm.

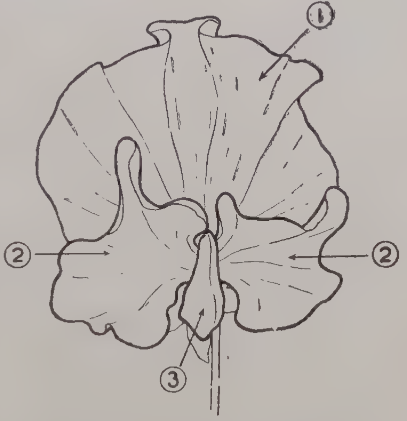
It is important that the organic manures should not be placed in layers or left in large lumps, but should be distributed throughout the soil, as sweet pea roots will tend to congregate in large lumps of manure and not leave it to utilise the rest of the soil.

Fertiliser and Lime

The topsoil is then worked back to refill the trench completely, working into this layer as it is refilled a dressing of well-rotted compost and a complete fertiliser, which must include an adequate supply of superphosphate, to which sweet peas respond particularly well. Gardeners often advocate bonemeal for sweet peas, but it is doubtful if this is more effective than the mixture which follows. A dressing of complete flower border fertiliser consisting of 3 parts blood and bone, 2 parts superphosphate, and 1 part muriate of potash, used at the rate of 2oz. a square yard, should be adequate. Although this contains some nitrogen, which is not normally needed by sweet peas, there is a possibility that the plants may benefit from this component under certain conditions.

Finally, apply garden lime to the surface at the rate of 4oz. a square yard, tread the top layer firm, and then prick over the surface with a fork, leaving it rough to ensure that all the rain soaks into the soil and does not run off.

This lengthy and laborious preparation of sweet pea sites usually pays a good dividend later in the size, quality, and abundance of the flower crop, as it ensures that each plant has a deep, extensive root system without which a long succession of good blooms cannot be produced. The number of weeks during which the display of flowers will last depends, more than anything else, on the care with which the soil was originally prepared.



The parts of a sweet pea flower: 1 the standard; 2 the two rings; 3 the boat-shaped keel.

A word of warning is necessary about taking out trenches in heavy clay soil impervious to water, where a trench simply serves as a sump for the collection of local drainage water and quickly becomes waterlogged in wet weather. In such soil it is wisest to prepare a much wider trench, or make some provision for surplus water to be drained away, or, preferably, dig over the whole bed deeply but without digging more deeply into the clay in one place than another.

The time of cultivation will depend on the method by which the sweet pea plants are to be raised, but in all cases the trench should be prepared, if possible, some weeks before it is required.

Methods of Raising

Although there is only one way of raising sweet peas—from seeds—there are three different methods of doing this, choice of method mainly depending upon the local climate.

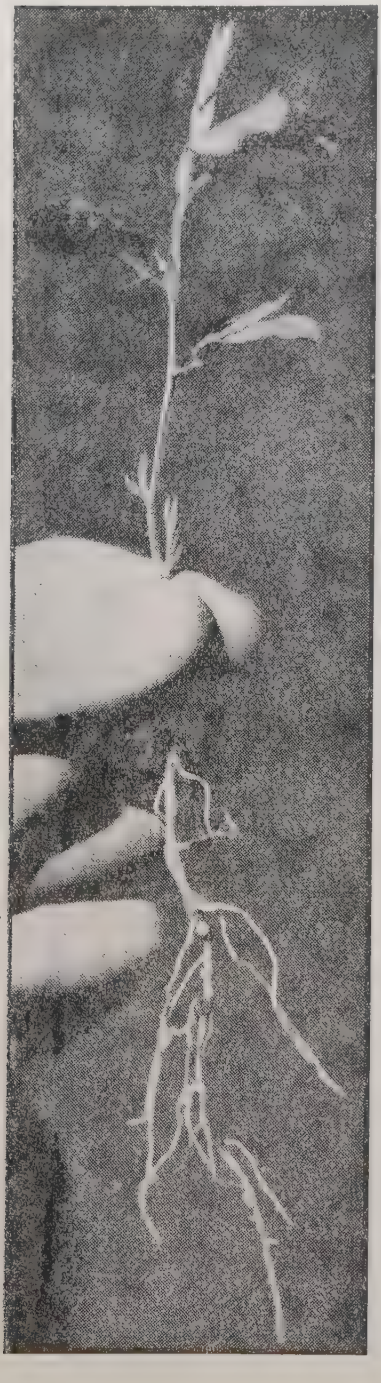
In very favourable districts seeds can be sown outdoors where they are to grow in autumn, preferably in March. This method produces the best results of all, and is favoured by gardeners who want to produce show blooms, but is inconvenient, especially if sweet peas are to be grown again in the same place, as it involves very early preparation of the site, where the previous season's plants may even still be in bloom. Plants from these very early sowings may make little top growth during the winter, but their roots are growing all the time and their extensive root systems enable the plants to produce better flowers and bloom for far longer than those set out later. Early flowering varieties may be sown as early as January in mild districts to bloom through the winter.

In less favourable districts, or where the site is not ready for autumn sowing in situ, seeds can be sown in pots or boxes and wintered in a cold frame, giving them quite hardy growing conditions and putting the light on only in really cold weather. Seeds can also be raised successfully in a sunny porch or windowsill. Show growers sow as early as the end of March to get plants for setting out before the onset of the coldest winter weather, by which time the site has been prepared, but for most home gardeners it is best to sow seeds in the cold frame between May and July to produce plants for setting out as soon as the soil is in fit condition for planting in early spring—July-August in very mild districts, September in cooler places, and early October in the south. Alternatively, seeds can be sown outdoors in the bed where they are to grow in early September.

In the coldest districts plants can be raised in frames, as described above, for spring planting, or seed can be sown outdoors in situ between mid-September and early October for the summer crop of flowers and a late sowing in November to produce flowers in the autumn.

Sowing Seeds

The black-coated types of sweet pea seeds do not readily absorb water and are often slow to germinate. It is worth while to "chip" these seeds with a fine file or pocket-knife, making a small nick in the coat of each seed opposite the light-coloured scar ("eye") where it was originally attached to the pod. Grey, cream, and speckled seeds should never be chipped, as they are already too liable to



A well-grown sweet pea plant ready for planting out. Note the warts (nodules) on the roots, and the two side shoots starting to grow, just above the thumbnail. (Each side shoot grows from the axil of a leaf, where it joins the stem, but these two leaves were removed for clarity.) When stopping seedlings the growing point should be nipped off just above the fourth leaf.

rot in the ground instead of growing and chipping aggravates this tendency. Some growers soak black seeds in water for 2 or 3 days before sowing, but chipping is a better method of ensuring germination, as soaked seeds will rot instead of growing if soil conditions are not just right for germination. The largest, plumpest seeds are supposed to make the most robust plants, although it is doubtful whether this is really the case.

When sown in pots and boxes seeds are usually spaced about 1½in. apart, black seeds 1in. deep and others only half that depth. Some growers cut a turf into 2in. squares, pack these upside down in a seed box, and sow one seed in each. At planting time the turves lift out easily, avoiding undue damage to the roots.

In the open ground seeds should be sown not more than about 2in. apart and at the depth described above. The plants can later be thinned out to the required spacing, but close sowing is advisable to allow for some loss by slugs and birds.

Stopping

There has been much argument among sweet pea growers as to whether it is best to "stop" sweet peas or not (that is, to pinch out the top of the young plant). Some hold that the original stem (maiden) should be allowed to grow, others that it should be decapitated just above the fourth leaf. This causes strong side shoots to grow and it is these which are allowed to develop. Yet other gardeners hold that the seedlings should be allowed to grow unmolested until one or two side shoots grow naturally (as they always do, on quite young plants) and that the top should then be pinched off just above the second side shoot (see illustration). This is called "waiting for a natural break." Even if the top is not pinched out, it is often these strong new shoots which produce the flowering plants, leaving the original stem to fade away.

Planting Out

Sweet peas grown for garden display should be planted not more than about 6in. apart, or thinned to that distance if seeds were sown in situ. For exhibition work fanciers usually set out the plants 12 or even 15in. apart. Planting should be done carefully, injuring the roots as little as possible and making a hole large enough to allow the roots to be fully spread out and not cramped into a bundle. It is common practice to nip off the longest (tap) root before planting. Each plant should be set at about the same depth as it was growing in the box or pot.

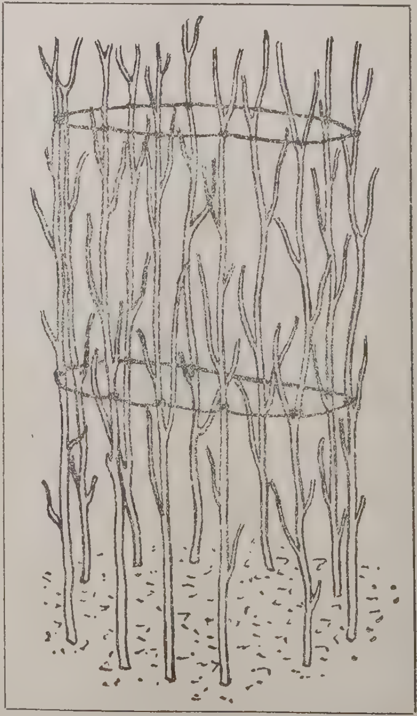
A short stake or bushy twig should be put to each plant as a temporary support when it is 4 to 6in. high.

Staking the Plants

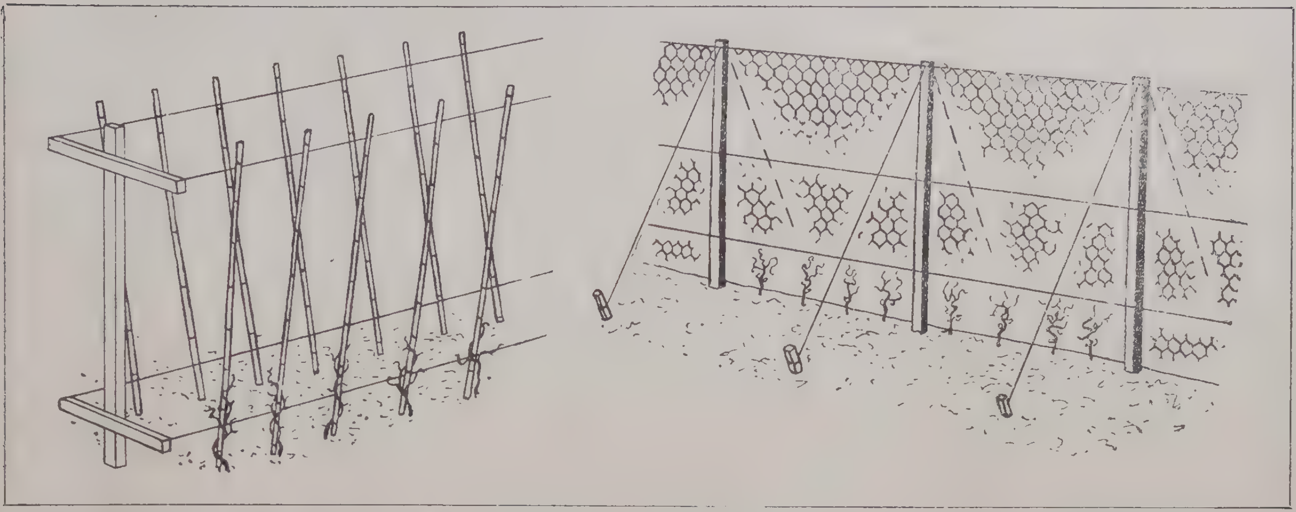
Sweet peas become heavy as they grow, and as a well-grown row presents a considerable area to the wind, they must be securely supported. There are many different methods of staking them, but whatever system is used it must be substantial and capable of standing up to the heaviest gales likely to be experienced in summer and autumn. Nothing is more disappointing than to spend time and trouble on growing good sweet peas only to find the whole row wrecked by a summer gale.

Although the various systems differ in detail, they all require strong, stout posts at each end of the rows and every 10 to 12ft. along the rows to serve as anchors and main supports. To these main posts, which should be stayed with guy wires if necessary, stout wires (at least 12 s.w.g.) are fixed along the top and a few inches from the ground, and the actual sweet pea supports then fixed securely at the top and bottom to these wires. The height of the row depends on the gardener's preference, but well-grown peas should fully clothe supports up to 8ft. high.

For garden decoration, where maximum display is wanted, wire netting, sheep netting, or long, brushy manuka branches are often used. Where the peas are to be trained as single cordons bamboo canes, willow shoots, or vertical wires can be used, all tied top and bottom to the main wires and arranged one to each of the cordons, which are usually grown 6in. to 12in.



Manuka sticks, looped together with twine, for training sweet peas in clumps.



Left—Bamboos or willow shoots tied to wires where sweet peas are to be grown as cordons. Right—Wire netting screen for best garden display.

apart. The cordons are then each clipped with wire rings or tied to their supports as they grow. On reaching the highest point at which they can conveniently be handled (6 to 7ft.) each cordon is released completely from its support by cutting the strings or undoing the clips, laid carefully on the ground along the foot of the row, and then the tip trained up another support 6ft. or so away from the first. It is sometimes necessary to repeat this process later in the season and, by the autumn, each cordon may be 15ft. or more long, yet still flowering profusely.

Watering

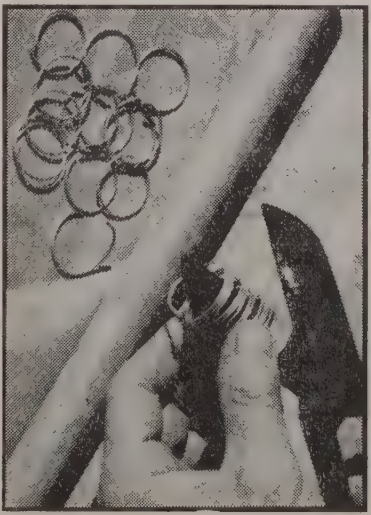
Well-prepared ground should hold ample moisture for the plants until well into the summer, but it is often necessary to water from then onward, as sweet peas must on no account be allowed to suffer from lack of water. It is a good plan to dig out a deep hole with a trowel from time to time to see whether the soil below the surface is still moist or has begun to dry out. A handful of the soil, when squeezed, should retain its shape on opening the hand. If the soil crumbles it is an indication that it is lacking in moisture and should be watered at once.

It may not always be easy to get water to soak into the subsoil, especially on sloping beds, where it may be necessary to make horizontal irrigation furrows or half sink in the soil a few tins from which the tops and bottoms have been cut and water into these.

Whenever the soil is watered it should be given a thorough soaking, then left a few hours and the surface lightly hoed to prevent the surface from caking. Frequent light waterings do more harm than good, giving the illusion that the soil is moist whereas it may be getting drier and drier a few inches below the surface as the sweet pea roots remove moisture from the lower levels. The experienced grower can see that water is required long before the plants show any sign of actually wilting by observing a greyish hue which is the first sign that plants are beginning to lack moisture.

Feeding

Later in the season when heavy flower production begins to check growth sweet peas will respond to regular feeding. This should be given to cordons when the first flower buds are forming, but bush-trained rows are not usually fed until the new year, when flowers begin to have shorter stalks. It is useless trying to improve poorly-grown sweet peas by feeding, which will be helpful only to plants which have a healthy root system.



Rings for clipping sweet pea cordons to their supports can be made by twisting 16 s.w.g. galvanised iron wire round a broom handle and then cutting the "spring" so formed into rings.

Well-grown plants will respond to applications every 2 to 3 weeks from the time feeding starts until the end of the season, but fertilisers should never be applied to dry ground, since this may cause injury to the roots. Unless the soil is reasonably moist it should be watered first with plain water, after which the feed may safely be applied, either dissolved in water or dry and then watered in.

Liquid manure, made by steeping a bag of animal manure in water for a few days and then diluting to the colour of weak tea, is often recommended and widely used by sweet pea growers, but satisfactory results can also be obtained by using a mixture of artificial fertilisers or one of the proprietary complete manures sold for the purpose.

The mixture recently recommended for feeding pot plants (6 parts sulphate of ammonia, 3 parts of superphosphate, 1 part of muriate or sulphate of potash) can be used with success, although it probably contains a higher proportion of nitrogen than sweet peas really require. It can be used dissolved in water at the rate of about 1oz. (1½ tablespoons) of the mixture in 2 gallons of water and watered on to about a yard of row, or the same amount may be scattered over the surface and watered in. In either case the feed should be applied evenly over the ground for at least 18in. on each side of the row and not all placed close to the plants, as the roots extend throughout the soil for a considerable distance on each side of the row.

CULTURE OF SWEET PEAS . . .

Training

There are four different ways of training sweet peas, each with advantages and disadvantages.

The **natural** method is to let the plants grow wild over their supports with no training at all, which is certainly the least trouble but results in their flowering for a relatively short season and producing many flowers with short or crooked stems.

The **regulated bush** system, very popular with home gardeners who want the maximum possible garden display, consists of growing plants on bushy supports or wire netting and thinning out a proportion of the new growths to prevent them from becoming too dense. This system produces the most flowers, and well-grown rows should be covered with blooms for quite a long season, especially if grown from autumn-sown plants, but bushy rows are rather prone to mildew and require fairly drastic removal of side shoots as soon as flowers begin to come with short stalks.

The **cordon** system, so necessary for the production of show blooms, consists of confining each plant to two, or at most three, shoots, all others being removed. Although the finest blooms are produced by cordon plants, and these often flower for months longer than bushy plants, each cordon bears relatively few flowers at any one time and a row of cordon sweet peas certainly does not make the vivid garden display that can be expected from the bush system. As already explained, all tendrils are removed from cordon plants and each cordon is tied into some form of support as it grows.

The **single-stem** system consists simply of growing each plant on one stem instead of two or three, as in the cordon system. A few of the relatively weak-growing red varieties do better on a single stem, while late, spring-sown plants can also be confined to a single stem, but sweet peas are usually better grown with 2 or 3 stems on each, as most grow rather too strong and coarse if kept to a single stem.

Thinning and Disbudding

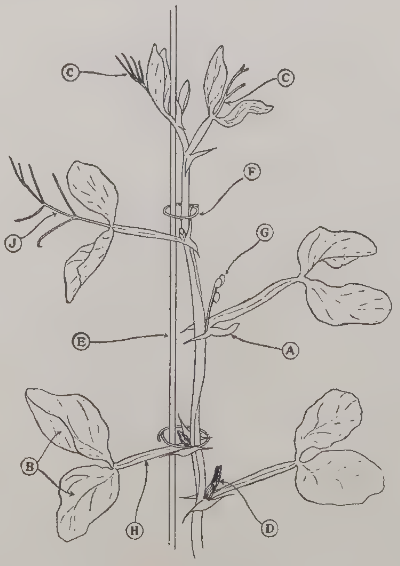
If sweet peas are to be grown as cordons (or single stems), the best of the side shoots should be selected as soon as possible when they start to grow, and all other side shoots removed by pulling or pushing them gently sideways until they drop off. As the plants grow side shoots continue to be removed each time they are tied up to their supports and tendrils are removed as soon as they can be seen between the leaf blades of young leaves.

Bush-trained plants can be thinned either by removing a proportion of the young side shoots as in training cordons, or by pruning out a proportion of side branches later, but the first method is by far the easiest and most satisfactory.

TRAINING CORDON SWEET PEAS

Each leaf has two pointed stipules (A), a flattened leaf stalk (H), two leaf blades (B), and a set of tendrils (C), which grow from between the leaf blades. As soon as the tendrils can be seen as at (C) they should be pinched out when training sweet peas as cordons. Those at (J) have been left too long and will soon be grasping, and mutilating, other stems.

A side shoot (D) grows out from the place where each of the lower leaves joins the stem. These side shoots should be rubbed out, by moving them gently sideways, when they are about at the stage shown in (D). The earliest flower buds (G) may also be rubbed out, but this is not usually necessary and may result in later blooms being too large and coarse.



Each cordon requires the support of a wire, string, or thin cane or willow shoot (E), to which it is tied at intervals or clipped with wire rings (F). Where the latter are used care should be taken not to scratch the tender flesh of the stem or leaves as the wire rings are put round and closed up. They should not be a tight fit but should leave plenty of room for future thickening of the stem, as shown in the figure.

Show growers often remove a few of the earliest flower buds while they are still quite small and do not allow the first blooms to develop until the plants are about 3ft. high. Some growers even remove a proportion of the later flowers to get the maximum possible size in those left to bloom for a particular show, but this removal of young flower buds (disbudding) can easily be overdone and may result in the production of very coarse, clumsy flowers.

Pick off Dead Flowers

The life cycle of an annual plant is completed when it produces a crop of seeds to ensure survival of the species, and most annuals then wither and die. Nothing causes sweet peas to cease flowering more quickly than to allow a few faded flowers to remain on the plant and develop seed pods. Whether grown as bushes or cordons sweet peas should be carefully inspected at least every two or three days from the time the first flowers are fully developed and flowers must be promptly removed as soon as the petals fade and long before there is any sign of a seed pod developing.

If it is decided to save sweet pea seeds for sowing, faded flowers should, of course, be left. No special precautions are needed to prevent cross-pollination, since sweet peas are automatically self-pollinated and normally grow true to variety from seed. The pods should be picked just before they are ripe, dried in an airy place, and then the seeds removed from the pods, discarding any which are small or poorly formed.

Use as a Cut Flower

Sweet peas are, of course, among the finest of all flowers for cutting. They are graceful, fragrant, last well in water, and are easy to arrange if well grown and cut with long stems. Flowers should not be cut until the top bud is half to three-quarters developed, as, unlike some flowers which are best cut in the tight-bud stage, sweet peas open very little further after being cut.

The best time to pick sweet peas is in the early morning, as soon as dew has dried off the petals, and if blooms are to be sent away they should then be stood nearly up to the flowers in water in a cool place for a few hours to have a "long drink" before being packed.

Show Work

Growing sweet peas for exhibition at flower shows can be a fascinating hobby for the home gardener who decides to specialise in the culture of this flower. Like most popular flowers, sweet peas well repay any extra time and trouble spent on them. Prize-winning show blooms, each with four perfect, well-placed flowers 2½in. across on strong stems 18in. long, are not produced just as a result of some trick or by growing some very special variety but by paying strict attention to every detail of their cultivation. It is not possible in a short article to describe in detail all the special cultural attentions which exhibitors give to their sweet peas, but those interested in this subject are recommended to read some of the books on sweet pea growing listed at the end of this article.

The "Sweet Pea Annual," published in Britain by the National Sweet Pea Society, always contains much information on sweet pea growing and especially on growing them for exhibition. The annual can be obtained from the hon. secretary, Mr. W. H. Hodgson, Old Mill Cottage, North Lancing, Sussex, England, by sending a British postal order for 5s. sterling.

Types of Sweet Peas

The following are the main types of sweet peas at present in cultivation:—

Grandiflora.—Improved varieties of the original type, with plain, unwaved standards.

Spencer.—By far the most popular type, comprising a multitude of varieties, all with waved standards, descended from the famous variety Countess Spencer. A few of these varieties have double standards (duplex type), which some regard as monstrosities, though others consider them to be an improvement on the type.

Early flowering.—More popular overseas than here.

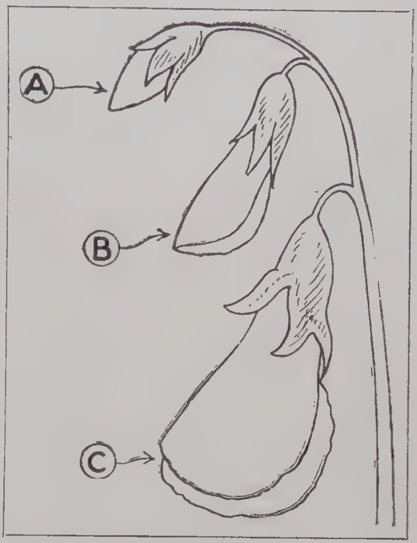
Dwarf or cupid.—Grow as small, bushy plants, not more than 9 to 12in. high, yet bear quite useful flowers.

Cuthbertson.—Introduced quite recently by a well-known firm of American seedsmen and have created much interest. Said to be more vigorous than Spencers, bearing huge blooms with very long stems.

Non-tendril.—A race of non-tendril sweet peas has been raised by a British firm and these, too, are said to produce a prolific crop of well-flowered spikes.

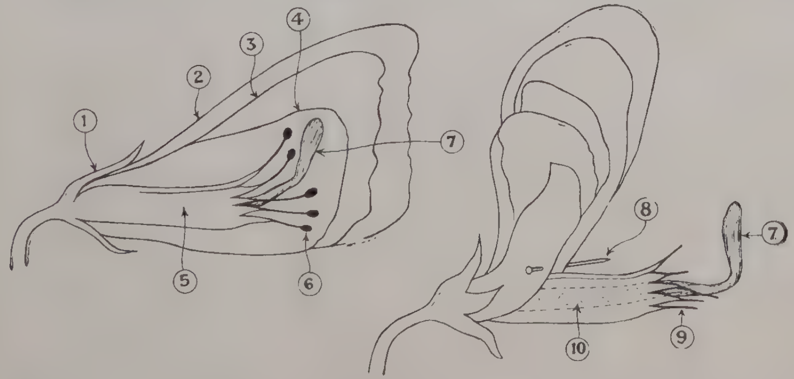
Varieties

There is a bewildering number of varieties of sweet peas from which to choose, nearly a hundred being listed in New Zealand and several hundreds overseas. However, most local seedsmen put up collections of a number of named varieties which succeed in their particular district, often offering separate collections of varieties suitable for garden display and for show work. Beginners are advised to grow these collections, keeping the varieties separate and correctly named so that those which do best can be purchased by name in another season.



Flowers must not be emasculated for hybridising too soon or too late. Bud A is not yet ready, bud C is probably too far developed, but bud B is in about the right condition for emasculation.

EMASCULATING SWEET PEA BUD FOR BREEDING



The keel (4) is pulled or cut off and the other petals, standard (2), and two wings (3) are pulled up and temporarily fastened out of the way with a pin (8). The anthers (6) are then removed by cutting them off with a pair of sharp, fine-pointed scissors or tweezers, taking great care not to injure the stigma (7). Pollen from the selected male parent is then applied to the stigma, the pin removed to allow the petals to resume their place, and the flower covered with a paper bag tied over the whole head to prevent insects from visiting the flower and possibly bringing unwanted pollen. Note: Each of the anthers is attached to a separate stalk (filament) (9), but the stalks join together to form a sheath (5) which encloses the young seed pod (10) in which the ovules are awaiting fertilisation.

Although sweet peas have a wide colour range, there is still no true buttercup yellow or gentian blue, while the petals of many of the red, pink, and orange varieties are scorched and burnt by bright sunlight and require shading with a muslin screen for a few days before a show when they are being grown for exhibition.

The following are among the most popular and well-tried varieties:—

Blue—Bluebell
Cerise salmon—Mrs. A.Searles
Cerise scarlet—Flamingo
Lavender—Ambition
Mauve—Chieftain
Orange—Royal Sovereign
Picotee (coloured edge)—Youth
Pink salmon—Debutante
Pink cream—Melody
Scarlet—Huntsman
White—Mount Everest

Raising New Varieties

Sweet pea flowers are normally self-fertilised, pollen passing from the male anthers to the female stigma before the flower opens. As the first step in raising a new variety is to cross-fertilise a flower with pollen from a flower of another variety, it is necessary to do this while the flower is still in the bud stage. This is done by pulling up the standard and wings, fastening them out of the way by sticking a pin through them, and then carefully cutting off the petals which form the keel. Next look carefully at the ten stamens to make sure that they have not already shed their pollen. If they look at all dusty, some pollen has probably been shed and it is too late to prevent self-fertilisation of that particular flower, so another less-advanced bud should be opened. If the anthers are quite free from pollen, cut them off with a pair of tweezers or fine scissors; there should be ten anthers and it is essential to remove every one, but great care must be taken not to injure the central style.

Select a flower at a slightly more open stage to use as the male parent, pick it, and take off all the petals. If the anthers are quite dusty with pollen, dab them gently on to the centre of the first flower to deposit pollen on the sticky part of the style. Provided pollen is seen to be adhering to the style, take the pin out, let the petals fall back into place, and put a small paper bag over the flower, tying the neck to prevent insects visiting it and bringing unwanted pollen. If pollen does not stick to the style, the flower is evidently not ready for pollination, in which case it should be covered with a bag, pollinated about two days later, and then covered up again.

The bag can be removed when the pod starts to swell, the pod picked when it is nearly ripe, dried in a windowsill, and the seeds removed when quite dry. The seeds from each cross should be kept separate and grown the following season, when results are likely to be disappointing, but these plants should be allowed to set seeds naturally (self-fertilised) and the seeds again saved and grown on. Plants in this second generation will usually show great variations and often some improvements, and it is from these that the breeder selects the desirable forms which are then grown on and rigorously selected and culled year after year until finally a new variety breeding true from seeds ("fixed") has been produced.

Of course, by crossing existing varieties the breeder is able only to ring the changes on the characters which those varieties already have in their hereditary make-up. Occasionally, however, a plant develops some entirely new character which sweet peas have not had before, due to what breeders call a "mutation" or sporting. When this happens the plant can be used as the parent of an entirely new type, or race, if the character is a desirable one, as happened when a plant developed frilled standards.

Sooner or later some lucky gardener may find a true yellow or blue sweet pea growing in his garden. If seeds are carefully saved, it may prove to be possible for breeders to extend the colour range of sweet peas still further, by using the "sport" as a parent of new crosses, or the "sport" may itself be put into commerce as a named variety.

Diseases and Pests

A number of diseases and pests occur on sweet peas but are not likely to be unduly troublesome if the site and soil are suitable and correct cultural practices are followed.

Aphids can be controlled by spraying with nicotine sulphate (1 fluid ounce to 4 gallons of water) made more effective by adding either soft soap (2oz.) or summer (white) oil emulsion (2 fluid ounces).

Slugs, which are especially fond of the young seedlings, are easily killed by use of metaldehyde bait (Meta fuel is at present the only form of metaldehyde on the market here).

Birds, especially sparrows, are often troublesome when the seedlings are coming through, but the row can be protected by means of fine-mesh wire netting pea guards, or by stretching one strand of black cotton tightly about 4in. above the row, tied to short sticks placed about 4ft. apart, a method which is usually very effective. The cotton will frighten birds, which cannot see it, provided it remains tightly stretched.

Mildew, showing as a white powdery layer on the leaves, can be a serious disease on sweet peas grown in shaded or confined places, but is not usually so troublesome on plants growing in the open. It can be controlled by dusting the plants thoroughly with flowers of sulphur or special horticultural dusting sulphur in the early morning when the plants are wet with dew.

Bud drop, causing flower buds to shrivel and drop, is not caused by a fungus or insect but is due to some cultural factor, such as application of an excessive amount of nitrogenous fertiliser, draughts, too much water causing waterlogging of the soil, too little light, sudden changes of temperature, etc., and those factors, which are under the gardener's control, should be properly regulated.

Virus diseases, causing mottling of the foliage or purplish streaks on the stems, cannot be cured but do not usually give serious trouble, though the latter may cause plants to die outright. Little can be done to control these diseases except to pull out and burn plants which are seriously affected.

Bibliography

Among books devoted to sweet pea culture the home gardener will find much of interest in the following:—

"Sweet Peas for all Purposes"—A. J. MacSelf, London, 1933.

"The Culture of Carnations and Sweet Peas"—E. O. Petersen, New Zealand, 1946. Price 1s.

"Sweet Pea Growing"—J. A. Heap, Shugborough Gardens, Great Haywood, near, Sheffield, England, 1946. Price 5s. Post free from the author.

"Sweet Peas"—C. W. J. Unwin, London, 1929.

Home-made Compost will maintain Fertility and Production

[*Photo News Ltd. photo.*

Gardens can be kept fertile and in full production by means of home-made compost, supplemented by the judicious use of fertilisers, without the need to purchase supplies of expensive, bulky animal manure. Compost heaps are here shown in a ¼-acre garden, the one on the right recently completed, the centre one maturing, and the heap on the left ready for use after being put through a 1in. screen. Material that does not go through the screen is put back on the most recent heap. A length of wire netting is put round each heap as it is built to keep it neat and tidy.

Third Session of Conference of FAO

By **J. V. WHITE,** *Investigating Officer, Rural Development Division, Wellington.*

THE Food and Agriculture Organisation of the United Nations held its third session of conference in the Palais des Nations, the home of the old League of Nations in Geneva, from August 25 to September 11. New Zealand's delegate at the conference was Mr. E. J. Fawcett, Director-General of Agriculture, and Mr. N. S. McClumpha, of the London office of the Marketing Department, and Mr. R. W. Marshall, New Zealand Trade Commissioner in Washington, were the alternates. Mr. A. P. O'Shea, general secretary of Federated Farmers of New Zealand (Inc.), attended the conference as an adviser to the delegation.

BECAUSE full meetings of the conference would have been unwieldy the actual work was achieved by three commissions, each of which set up small study groups for specific purposes. Commission I dealt with the world food and agriculture situation, Commission II was concerned with the technical activities of FAO, and Commission III with constitutional, administrative, and financial questions.

World Food Situation

The critical food position of Europe, Asia, and parts of the Middle and Far East, particularly during the present winter, was a factor which loomed ominously in the background of all deliberations at the conference. While 38 million metric tons of bread-grain imports would be needed by the deficit countries to continue even the very low cereal rations of the past crop year, it appeared that only 29 million tons, at most, would be available for export from the surplus-producing countries. A conference document, "The State of Food and Agriculture, 1947," contained figures and information which made depressing reading—reduced maize crops in North and Central America, smaller grain acreages in Latin America, a potentially good Indian wheat crop scourged by rust, and reduced rice crops in south-east Asia. It was quite obvious to the delegates, too, that Europe was experiencing a severe drought which, following an exceptionally severe winter, had resulted in a great reduction of grain, milk, butter, cheese, and bacon supplies. In fact, cases were recorded of livestock being slaughtered because of the shortage of feedstuffs.

An acute shortage of the requisites for agricultural production, especially farm machinery and equipment, fertilisers and insecticides, was shown by statistics. New Zealand farmers who depend mainly on phosphates (supplies of which are building up toward pre-war levels) will, perhaps, find difficulty in understanding the heavy use of nitrogenous fertilisers in Europe, especially for arable farming. As most of the nitrates for Europe are produced synthetically by processes which depend on coal, the need for increased coal production was emphasised by several countries.

Acute shortage of foreign exchange in countries most in need of food imports is a factor of increasing importance and it is recognised that much will depend on the progress of the Marshall plan for the economic rehabilitation of Europe.

To ensure the maximum utilisation of available supplies the conference recommended reducing to a minimum the quantity of bread-grains fed to livestock, strengthening measures for the collection, distribution, and conservation of supplies, maintaining high flour-extraction rates in deficit countries, and, if possible, raising them in surplus-producing countries. It was also suggested that the greatest possible proportion of milk output be utilised for human consumption (wherever transport facilities make this at all possible) instead of animal feeding, and that the export of stock foods to countries where the livestock population has been seriously depleted should be increased.

Fertilisers and Farm Machinery

Commission I, concerned with the food and agriculture situation, and Commission II, dealing with technical questions, both considered the question of fertilisers and farm machinery as constituting the basis of all agricultural production, and a working group, set up by Commission I, studied the question in detail. The report of this group, adopted by the conference, recommended that member Governments make special efforts to provide the necessary materials for existing producers of nitrogenous and phosphatic fertilisers to operate at full capacity, that member Governments improve their own measures for internal distribution and use, and that exporting countries review their own requirements to see if more could be released for other countries. It was recommended also that FAO should assist countries to use available fertiliser supplies most effectively and should help to provide the necessary transport.

With regard to the longer term position it was recommended that FAO, during the next five years, obtain additional information, particularly on farm requirements, and that the council of FAO consider what further action, including possible measures for assuring markets for expanded fertiliser production, could produce adequate increases in output.

Nations were recommended to encourage increased output of farm machinery in existing plants, especially of spare parts and tractors, and it was suggested that FAO obtain information which could serve as a guide for developing increased production.

Security for Producers

Discussion on the report issued by the Preparatory Commission on World Food Proposals set up to consider suggestions made by Sir John Boyd Orr, director-general of FAO, constituted the main work of the conference. The Preparatory Commission recommended the general expansion of agricultural production and set out in detail how this could be accomplished. It was recognised that expansion of agricultural production would involve a method of ensuring security for producers especially in assured markets and stability of prices.

To achieve this two alternatives were proposed:—

1. To create a world food board with financial resources and wide powers to fix a general policy incumbent on the various member States.
2. To allow the member States to retain their freedom of action.

The latter system was preferred, with the proviso that a council should be created within the organisation to ensure the co-ordination of the policies of the various States toward implementing FAO policy. The report of the Preparatory Commission was generally endorsed by the conference, which took the preliminary step of establishing a council of FAO of 18 members.

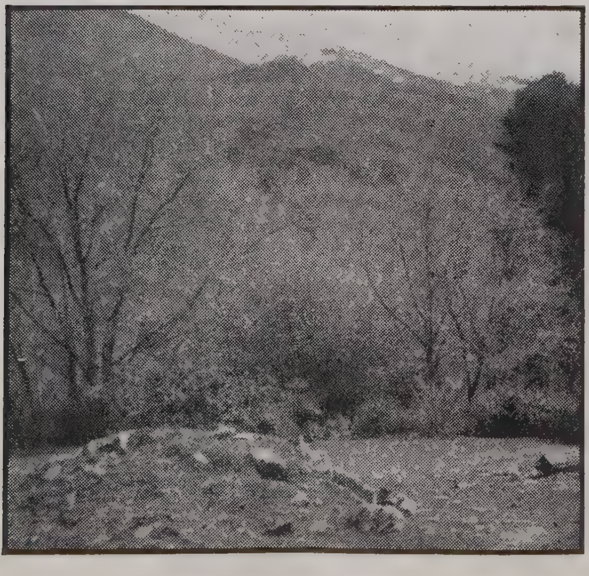
The conference emphasised the importance of inter-governmental commodity agreements for individual commodities, and it was generally accepted that the agreements represented the only practical way that producers could be assured of stability in their production programmes and consumers of a reasonable price level over a protracted period. The conference also stressed that FAO, through its newly-established council, must take a lead in the study of commodities and, if necessary, arrange for conferences at government level to finalise agreements.

OF MEN AND MOUNTAINS

THE mists lay thick over the Queenstown mountains. It seemed as if overnight the sky had reached down and claimed the great crags and silvery crests for its own, leaving even mighty Walter Peak no larger than the merest foothill. Along at the moorings, where the shore shelved suddenly to a depth of over 1000ft., the little boats looked like flecks of cloud on the greenstone water. We had traversed the ancient Maori camping place by the lake edge the previous evening and walked a while in the direction of Table Bay, where Nicholas von Tunzelman, who had a Tsar of Russia for godfather, and was the first runholder on the western side of Wakatipu, threshed his grain before sending it to the Frankton flourmill. The tranquil trees, mirrored in the shadowy water, and the ducks, swimming so effortlessly, had an ethereal quality, inclining the beholder to reverie. Suddenly, however, our pleasant musings were shattered by a hail from the homestead indicating that our departure was due if we were joining in the expedition to the farthermost end of this huge station, whose 170,000-acre territory extends through three different counties, and whose boundaries are measured by lake margin, rivers, and mountain ranges.

It is an 8-mile drive to Mt. Nicholas over fertile grasslands where once the moa roamed. Several skeletons of these gigantic birds have been discovered here, also mounds of white stones from their crops. The area was also a favourite hunting ground of the Maoris, and one of their ovens is still to be seen in a perfect state of preservation back among the hills.

We stopped near the remains of the old Mt. Nicholas homestead just long enough to unload supplies and pick up a new passenger—a typical back-country labourer as weather-beaten as the lonely hill-places where he had spent so much of his life and with a primitive, earthy flavour to his speech. At one time he had lived for a whole year on Pigeon Island, the largest of the three islands we could see near the head of the lake, and he had been dubbed "The Hermit" in consequence. Thousands of wild pigeons sought sanctuary on the island, hence its name; and all manner of birds, including waxeyes, redpolls, fantails, and finches, flourished there exceedingly owing to the absence of vermin. The Hermit used to string pieces of fat on the trees and put out apples and other titbits for them to feast on, and some of the birds became so tame that they would fly down on to the table and eat from his hand at meal-times, and the ducks always came to meet his boat when he had been out on the lake. With the feathered folk for friends solitude held no terrors for this twentieth-century St. Francis in the coarse dungarees and dilapidated felt hat.



"Only a heap of stones remained of the house . . . "

Turning south, we left the lake behind and headed up a hill road which soon turned so sharply that the distinguished traveller who thought that the car could not possibly negotiate such a bad bend and besought the driver to let him out before they crashed over the precipice could well be pardoned for his apprehensions. However, the driver's skill was more than equal to the test, and the spot has been known as "Let Me Oot" Corner ever since Sir Harry Lauder's visit!

Now we could look down on the valley where von Tunzelman had his original homestead among the trees. (This was the famous Fernhill property, the smaller runs at Table Bay and Beach Bay being later ventures.) Further on we witnessed the meeting of the waters, the Von and the Gilbert, one river being called after the intrepid Russian, and the other bearing the name of his fellow-explorer, William Gilbert Rees, and of Rees's brother-in-law John Gilbert, who was drowned in 1862 while swimming in the Clutha. We marvelled at the panorama of river terraces. As the lake level receded through the ages the creeks and rivers followed it down, carving their way through banks of solid rock to a depth of over 200ft. in a succession of terrace formations. Our route lay along the left bank of the Von, seemingly placid in the summer sunlight, but turning into a roaring torrent in the snow season, scouring out fresh channels and engulfing everything in its changing course.

The mists had lifted by now, just as my companions had foretold, and the brilliant blue of the sky appeared to be superimposed on the summits ahead. Pasture Hill, from whose heights the early settlers, pausing in their long journey by foot from Southland, could see both up and down the lake, had no less than 14 different colours on its gentle slopes—bronze and brown of bracken, the whole gamut of greens in grass and scrub growth, tawny yellows and golds of clayey cliffs, cobalt-shadowed hollows, long purple scars caused by erosion, shingle slips of silver and slate-grey, and a red carpet of piripiri unrolled at its foot. As we climbed higher and higher up the narrow road winding over Gorge Hill the wayside grasses glittered with diamonds left by the departing fog and there was a lavender haze on the distant ridges, and the patches of bush were a bright navy blue. This unusual colouring showed up even more distinctly when viewed through dark glasses. By now we were right in the midst of the mountains, bumping over boulders, fording creeks, jolting across tussocky plains, and on one occasion surmounting a hillock of stones which a slip had brought down upon the track. It was not surprising to learn that this area is quite impassable in winter.

At the bottom of a steep valley where a stream had gouged out a precipitous bed and the docks splashed vivid rust and carmine leaves upon the banks there was a rough bridge of red birch rails, but the angle of approach was so sharp that we had to back the car before we could get over, and the bridge shook as if it would collapse at any moment. Some idea of the hazards of our route can be gauged from the fact that it had taken us fully 3 hours to travel 26 miles, and we were all glad to reach the Von hut overlooking the immense flats which serve as drafting paddocks. Horses used to be trained here for the Southland races in the early days, and one of the large paddocks is still referred to as the Race Track.

The hut itself, of corrugated iron with a sack-lined ceiling to shut out the icy winds, had an earthen floor and an outsize fireplace backed by blackened boulders. Some wisps of dry grass and bracken set in a hollow among the ashes, a handful of chips and half a dozen slabs of white birch stacked lengthwise above them, the spurt of a match to the fern, and in a few seconds the logs had caught alight and the flames were curling about the witch's cauldron suspended over the fire by a long chain, and plumes of fragrant smoke were rising up the chimney. Two wide shelves along the far wall held an amazing array of utensils—billies and big iron pots, tin plates and pannikins, several enormous enamel teapots, a collection of cutlery comprising everything from a soup ladle to a salt spoon, a girdle pan of gargantuan proportions (equally good for cooking scones or grilling chops), and the pioneer's standby, a colonial oven.

Each of the six bunks at the other end of the hut had its own individual touches furnished by former occupants—a shelf for writing materials or a bookcase contrived out of oddments of wood, a box converted into a cupboard, a natty little candlestick cut from tin, a portion of the wall papered with pages of an illustrated weekly in lieu of the more conventional covering. (Most station hands, by the way, apparently prefer their literature, like their work, to deal with the "great outdoors," for all the books by the bunks were of the wild western type with titles like "Hurricane Range" and "Riders of the Hoodoo Ranch.") The same ingenuity in making the most of the materials to hand was shown in sundry other articles to be seen about the hut. A rag wrapped round a stick did duty as a dish-mop, twists of fencing wire were used as hooks, holders for candles, a toasting fork, and the mainstay of a tobacco tin soap-saver, and the handle of the bucket we took down to the spring had a sheep-bone strung on a piece of wire for a handle.

It would have been pleasant to linger in the shade of the willows, where the water welled up among the rocks, but as we still had many miles of rough country to cross before we reached our destination, when we had tidied up the lunch things we were on our way again, past the kennels dug out of the hillside (the interiors were timbered and the sods replaced on top of the roof iron, giving them an igloo effect) and along a mountain road lined with huge lichened boulders, grim monuments of the ice age, during which they had rolled down these slopes. A pair of paradise ducks presented a striking study in black and white as they rose from the reeds a few hundred yards from where we stopped to inspect a new sheep dip, the latest in concrete construction, complete with ramp and draining pens so that 5000 sheep can be put through in one day. Now and again we could detect a sheep against a gravelled mountain face, but most of them chose to roam the heights during the summer months.

At Bullock Creek, which would have been considered a sizable river in a locality where the scenery was not on such a stupendous scale, the crossing had been carried away by a previous flood, and while the men debated the possibility of getting the car across two of us forded the water on foot and climbed up to Bullock Hut, where the great birch forests begin. In the heavy winter of 1939 an avalanche swept down behind the hut, shearing away a swath of trees as if they were twigs, and then fortunately veering away in another direction. The cabin was built entirely of birch, bark-covered trunks being used for the corner-posts and crossbeams, and smaller logs for the walls. Even the beds were made of boughs, and instead of mattresses they were piled with pale, golden straw, calling to mind the lovely lines of the Lutheran cradle hymn. On a post outside hung three branding irons bearing the diamond pattern belonging to Walter Peak station. (The cattle yards were just in the next gully.) By the time we clambered down over the tussocks the car was there to meet us, the new passage through the shingle furrows and brown creek waters being marked with cairns of stones and tall stakes. Further on there was another stream too deep to ford, but the men bridged the close-set banks with slabs of timber, so that the delay was only a slight one, and we were soon in sight of the southern end of the station, where a wire fence stretched down the mountain side and across the valley and disappeared in the bush-clad range on the other side. As we sat on the river bank in the sun and watched the water flowing past the little islands of grass and green weed the cares and problems of our everyday existence seemed very remote and unimportant. . . .

Bullock Creek was negotiated without incident on our return trip, and as we went through the old valley of the Von the wild hawks wheeled overhead and the wind ruffled the grasses in small, swishing waves and

. . . grimmest ridges looked softer through
The clinging film of their gentle blue,
Where high in the haze of the summits show
The cool, faint streaks of belated snow.
And all, from the mountain, the great plain o'er,
To the sickle-blade of the curving shore,
From earth below to the heaven's height,
Was pierced and filled with the living light.

" . . . the cookhouse was still intact and used as a mustering shed."

Zig-zagging down Gorge Hill, we had a clear view of the three round knobs which form the back of the hill of many colours, and our thoughts were of those gallant pioneers who had tramped over these passes before roads or cars were dreamed of. Some miles down the valley we drew up at a white gate and got out to explore the wonderful old garden made by two brothers by the name of White, British Army officers who had served in India before coming to New Zealand with their two sisters in 1860. The front drive was paved with stones set level with the ground after the fashion of English cobbles, and colonnades of stately elms formed Gothic arches overhead. Brambles and bidi-bidis overlay the circular paths, the flannel leaf thrust up stems of bright-yellow flowers among the stones, and sycamore seedlings grew like a miniature forest underfoot, but it was still possible to wander beneath the huge oaks and Wellingtonias, the hollies and horse chestnuts, and the conifers and larches. A cork tree was a distinct curiosity, likewise a tremendous passion fruit tree with fruit like little green apples that would later turn black when fully ripe, and gnarled quinces and apples and heavily-laden pears surrounded a central grove of walnuts and hazelnuts shading a round hollow which had once been an ornamental pond, the water having been brought down from a race in the hills.

The flower beds had long since reverted to grass, and box thickets and tangles of roses (the red, rich-scented variety) were the sole traces of former loveliness. Only a heap of stones remained of the house, but the cookhouse with its long, low roof, faded vermilion doors, and wide stone chimneys at each end was still intact and used as a mustering shed. A big wooden table occupied the centre of the room, there was a capacious corner cupboard for stores, and a row of tin plates gleamed on the sheet-iron mantelshelf. Countless meals had been cooked in those blackened pots, countless tales told down the years as weary men, coming in from a hard day's work among the mountains, drew closer to the fire's comforting warmth set in soft circles of light cast by the hanging hurricane lamps. . . .

Rabbits scuttled away at our approach as we proceeded through the lower valley. The Von was a silver chain linked to the sapphire pendant of the lake. The late afternoon sun had turned the hills to gold, and the trees by the lake edge looked as if they were fashioned from jade. We were nearly at the end of our journeying now, and ahead of us we could see the mountain after which this vast station is named —magnificent Walter Peak, amethyst-crowned against a cloudless sky.

Mary

[Photographs by Florence Mackenzie.

SALAD SUGGESTIONS

By

Eva Topping.

[Sparrow Industrial Pictures Ltd. photos.

Boil even-sized beetroots until tender; skin and cool. Scoop out the centres with a teaspoon and pour one teaspoon of vinegar into each beet. Make a filling with hard-boiled egg, chopped chives, and parsley; drain off any surplus vinegar and fill cups with egg mixture. Arrange on shredded cabbage, lettuce or endive, or on watercress. Chop the pieces of beetroot that were scooped out and use as garnish. Celery, apple, hard-boiled egg, and small pieces of pickled onion will also make a good filling.

Chopped apple and celery with grated cheese arranged in cups of

IMPORTANCE OF MILK IN THE DIET

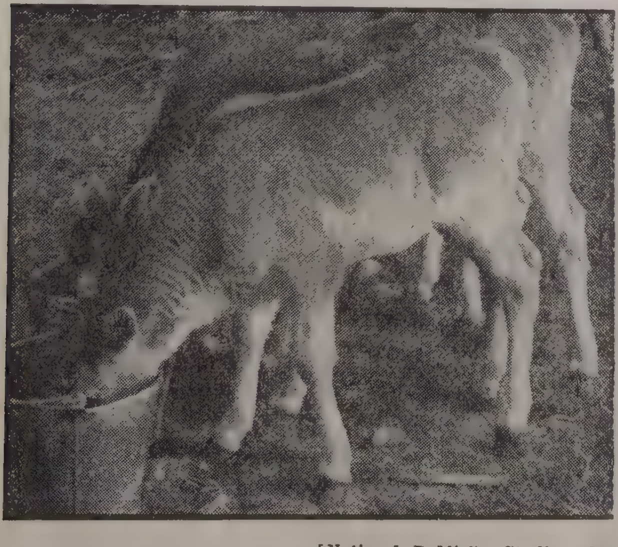
INCLUSION OF NECESSARY QUANTITY DAILY

By EIRENE UNWIN, *Rural Sociologist, Dunedin.*

THAT all children from two years upward should consume 1¾ pints of milk a day has been advocated by a Technical Commission set up by the League of Nations. Nursing or expectant mothers should have the same amount, and, if possible, other adults should too, though their milk can be cut down to a pint if necessary for economic reasons. The Technical Commission worked out the requirements of the human being "for the best possible or 'optimum' nutrition," which is described in the Department of Health publication "Good Nutrition" as "a state of physical well-being which cannot be improved by any change in diet."

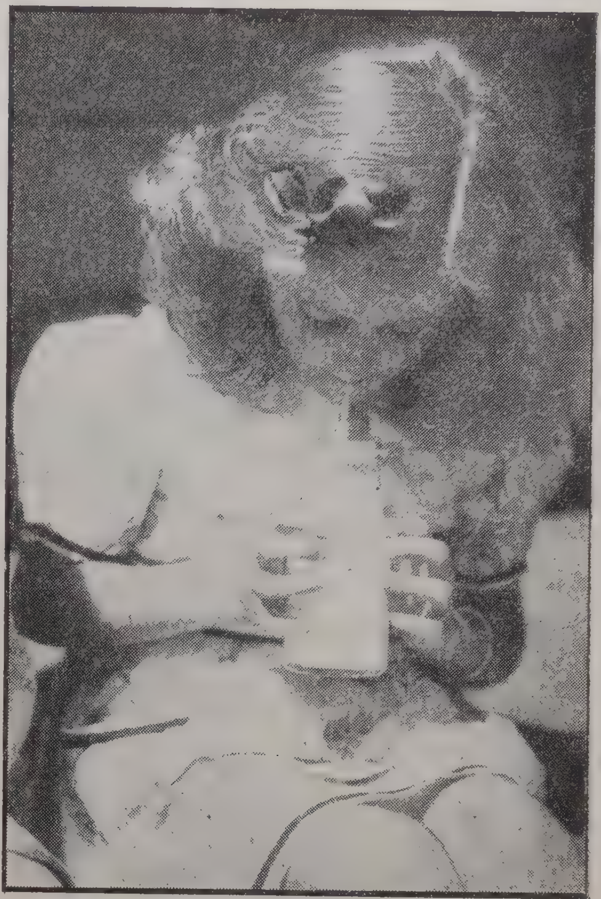
THE commission's recommendation may provoke the remarks, "But that's an awful lot of milk. Is it all really necessary?" and then, "How on earth am I to get my children to take a pint and three-quarters of milk every day?" This article answers the first question with an emphatic "Yes, it is all necessary," and goes on to show ways and means of doing it that will be readily acceptable to children and adults alike.

Why should so much significance attach to the consumption of such a quantity of milk rather than to any other foods? As milk is the calf's only important food for many weeks, it must contain all the essentials for the growth of the young calf, and as young people and young calves require much the same substances to make their bodies grow healthily, milk must also be an excellent food for children. Similarly it is an excellent food for adults, because in addition to its body-building qualities it has body-repairing and health-giving effects as well.



[National Publicity Studios photo.

Milk is the calf's only important food for many weeks. It contains all the essentials for growth and is therefore an excellent food for children too.



[Department of Internal Affairs photo.

Proof that this is so has been obtained from experiments in which extra milk has been given to groups of children over a period of months and their heights and weights compared with those of similar children not receiving the extra milk. In every case quite startling results were obtained, the increase at the end of three months in the height of the children receiving extra milk being sometimes twice the increase of those children not receiving it, and the increase in weight being two and a half times as much.

This was not an isolated experiment. Many similar experiments all show similar results, and teachers report that children are now showing greater activity and alertness than before they were getting their half pint of milk daily at school.

The constituents in milk which are so valuable and the use the body makes of them are summarised in the table on the next page.

The only two diet essentials missing from milk are iron and vitamin C. Vitamin C is present in quite fresh milk, but is rapidly lost as the milk stands. Iron is not contained in milk in appreciable amounts; both babies and calves before birth are given by the mother a supply of iron which is stored in the liver and utilised during the first few months, after which other iron-rich foods can be fed.

The most important contributions of milk to diet are protein for body building and repairing, lime and phosphorus for teeth and bones, and vitamins A, B1, and B2

AVOIDING CONTAMINATION OF MILK . . .

for general health and well-being. Lime is probably the most important of all.

No other single food provides anywhere near the body's daily requirement of calcium or lime. Anyone consuming less than 1¾ pints of milk a day is almost sure not to be getting all the lime needed. The lime in milk, too, is more easily and more completely used than the lime in green vegetables. To get the same quantity of lime obtained from 1 pint of milk approximately the following amounts of other foods—and these are the only other common foods containing appreciable amounts of lime at all—would have to be eaten: 5lb. of cabbage, or 4½lb. of carrots, or 3oz. of cheese, or 21 eggs, or 14oz. of broccoli, or 34lb. of potatoes. So for the lime it contains alone it becomes obvious that everybody should try to take at least a pint and children a pint and three-quarters of milk a day.

"The reason why 1¾ pints of milk has been advocated by the League Commission," states the Health Department publication "Good Nutrition," "is that in America the growth-rate of children has not been optimal unless this quantity of milk has been included in their day's food. American climatic conditions are not very dissimilar from our own, and we may assume that New Zealand children need a similar quantity."

Quality as Well as Quantity

But it is not sufficient to take the required amount of milk daily unless the quality of the milk is also up to standard. There are two ways in which milk may be unclean. It may have material contamination ("dirt") or bacterial contamination (germs) in it. It is the dairyman's responsibility to see that his milk is as clean as possible in both these respects, and it must be remembered that pasteurising affects only the second type—it does not make dirty milk clean.

The first possible source from which milk may be contaminated is the cow. If she is infected with a disease the germs of which can be transferred to her milk, and if those disease germs can cause illness in humans when taken by mouth, then a diseased cow can be directly responsible for an outbreak of that disease among the consumers of her milk. Particularly is this the case with tuberculosis. It is compulsory for owners of registered dairies to have their herds tuberculin tested every six months, and new stock should be tested within a week or two of purchase. Those who haven't a registered dairy but keep only a few cows for their own milk supply should also avail themselves of this service provided free by the Department of Agriculture and have their cows tuberculin tested regularly. If they do not there is a grave risk that sooner or later a member of the family may contract tuberculosis from the milk. Tuberculin testing is free and if an infected cow has to be destroyed the owner receives cash compensation for a proportion of its value.

Another less well known but surprisingly common and unpleasant disease that can be passed direct from a cow to a consumer of her milk is undulant fever. In cows this disease takes the form of contagious abortion, but in humans it is a debilitating illness lasting sometimes many months, causing recurring periods of great weakness and fever, and all the time lowering resistance so that the sufferer becomes very liable to contract some other dangerous disease.

The cow, too, can pass other than bacteriological contamination on to her milk. Dr. E. R. Peterson, America's leading authority on milking practice. in some recent experiments discovered, as he states in the dialogue of the film "The Science of Milk Production," that "the odours from moth balls, silage, turpentine, and many other substances passed from the lungs into the blood [of the cow] and from there into the milk. This proves that flavour as well as nutritional values should be considered when you are looking for quality milk production." Strong flavours thus imparted to milk are seldom actually harmful to the consumer, but may make the milk very unpleasant.

CONSTITUENTS OF MILK AND THEIR USE TO THE BODY

Constituents in good or fair supply in milk	The use of these constituents to the body
1. Protein — of first-class quality (good)	For health and growth, building and repairing tissues.
2. Minerals—	Body builders and regulators.
(a) Calcium or lime (good)	Essential for building hard bones and teeth. Helps clotting of blood after skin abrasions.
(b) Phosphorus (good)	Essential, with calcium, for hard bones and teeth. Necessary for all the body cells and fluids to function properly.
(c) Iodine (fair)	Prevents goitre. Keeps thyroid gland healthy.
3. Vitamins	Body regulators. For health and well-being.
Vitamin A (good)	For growth. For health of skin and membranes of body, especially membranes of eyes and lungs. Prevents or cures night blindness.
Vitamin B1 (fair)	For growth. Stimulates appetite and digestion. Prevents beri-beri, a paralytic disease. Necessary for the use of starches and sugars in the body. Maintains tone of muscles in the digestive tract; hence lack is associated with chronic constipation, etc.
Vitamin B2 (good)	Promotes growth and general well-being—real fitness is impossible without it. Helps prevent sores round mouth and eyes.
Vitamin D (fair)	Helps body make use of calcium and phosphorus present in foods, so is necessary for formation of good bones and teeth. Promotes growth.
4. Carbohydrate—sugar	Provides heat and energy.
5. Fat (fair)	Provides heat and energy.

The second important source of milk contamination is not from the cow at all, but from external sources to which the milk may be exposed after it has been drawn from the cow. Careless milking practices, insufficient washing of the udder and teats before milking, leaving milk uncovered in buckets or the tank of the separator for periods when dust might blow in, cooling the milk where dust can blow on to it, insufficient or inadequate straining, etc., all invite dirt to collect in the milk. Such dirt is readily seen in the dregs from a jug or cup and is most unpleasant, but with scrupulously-clean dairy and milk house practices it can be largely avoided.

More serious probably than dirt, which can be seen and so draws attention to itself, is bacteriological contamination; for germs not only cannot be seen, but find milk, especially uncooled milk, an excellent feeding and breeding ground, and once in the milk multiply rapidly, often to dangerous proportions. Germs harmful to man which thrive in milk, besides those of tuberculosis and undulant fever, are those of diphtheria, scarlet fever, typhoid, septic sore throat, summer diarrhoea, and dysentery. They can get into the milk very easily. If anyone handling the milk is infected with any one of these diseases, or in some cases has been in contact with some infected person or other infected source, or if dust containing the dormant germs has access to the milk, then the milk may become infected and so spread the germs and the disease to its consumers.

The first way to prevent this is to try to prevent the milk from becoming contaminated, but as there is no sure way of absolute success in this, it is well always to carry out the second precaution, pasteurisation. Pasteurisation destroys all germs in milk that are harmful to man, and, if properly done, it does not impair the nutritive value as boiling or scalding does.

A word of warning, however, is necessary about the use of pasteurised milk. Pasteurising destroys all harmful germs present in the milk, but unless the milk is kept sealed in sterilised containers it can become recontaminated. If the bottles are opened some time before use, or the milk poured into jugs, fresh germs are

[*Sparrow Industrial Pictures Ltd. photo.*

All these foods contain calcium (or lime), but to get the same quantity of lime obtained from one pint of milk approximately 5lb. of cabbage, or 4½lb. of carrots, or 3oz. of cheese, or 21 eggs, or 14oz. of broccoli, or 34lb. of potatoes would have to be eaten.

very liable to enter it, and especially if the milk is allowed to get warm, multiplication of such contaminating germs will occur very rapidly, as the development of the lactic acid bacteria normally present in milk and hindering the development of germs has itself been hindered by the pasteurisation. This effect is even more marked with boiled milk, as boiling completely destroys these beneficial bacteria, and as recontaminated boiled milk can go bad long before it goes sour, there is no taste of sourness to warn the consumer that boiled or pasteurised milk is no longer safe to drink. Pasteurised milk, however, if kept clean, will go sour before it goes bad, as the germs causing it to go bad have been destroyed, whereas the bacteria causing souring have only been hindered. This is a good thing, for pasteurised milk kept sealed normally keeps longer than untreated milk, but when stale it will sour and warn the consumer of its staleness. So pasteurised milk should be kept sealed in its bottles in a cool place and poured into sterilised jugs just before it is needed.

If only unpasteurised milk is obtainable in the country or if milk from one's own cows is used, it is wise to pasteurise it oneself, especially when it is going to be used for children. At least milk should be cooled and kept cool to hinder the multiplication of those germs already in it, and also kept covered to prevent fresh germs from contaminating it further.

To Pasteurise Milk at Home

Heat the milk, covered, in a double saucepan over hot water to 160 to 180 degrees F. and hold it at this temperature for 20 minutes, not letting it get any hotter. Stir it occasionally and use a thermometer. Then cool it quickly (see note in next section on the best way to do this). Keep it in sterilised jugs, covered, in a cool place till required.

Effect of Cooking and Adding Other Substances to Milk

The protein in milk is of two kinds. Most of it is not affected by heat, but is clotted by the addition of acid or rennin or souring. Thus to avoid curdling when combining acid and milk, the acid should be added slowly to the milk (not the milk to the acid) and the milk stirred all the time. This should thicken but not curdle the milk. Gelatine does not curdle milk unless heated to quite a high temperature with it. When hot liquid containing gelatine is to be combined with milk, if the gelatine is added carefully to the cold or cool milk, not vice versa, and stirred well, curdling should not occur. If possible, of course, the gelatine liquid should be cooled a little first.

The other protein in milk is hardened with heat, as well as with acid. It is this protein which forms the skin on heated milk and the coating on the sides and bottom of the saucepan. As it hardens some of the fat and lime is entangled in the skin, so this should be beaten into the milk and used, not thrown away. If the milk is covered while being heated, the skin is less likely to form, and when scalding milk it is wise to heat it, covered, over boiling water, where it cannot boil over or burn and does not need watching. Loss of the protein and lime on the sides of the saucepan and in the skin is minimised if the milk is heated to just the required temperature and not held at that temperature for any length of time or allowed to get hotter than needed.

To cool scalded or home-pasteurised milk stand it in a jug in a bowl or saucepan, or the sink, and run the cold tap into the bowl. Water may be prevented from splashing into the milk by wrapping a dish cloth round the tap so that the cloth drops down into the bowl and the water runs down it. As skin can form on the scalded milk even while it is cooling, it should be stirred for the first minute or two while it is cooling. It is important to cool sterilised milk quickly, whether it is boiled, scalded, or pasteurised, and to keep it cool, for if it is allowed to stay warm it becomes an excellent breeding ground for any fresh germs that may have entered.

For those who do not milk their own cows and may be troubled about the cost of supplying a family with 1¾ pints a head a day the use of separated milk to supplement the whole milk bought is recommended. When milk is separated—when the cream and substances dissolved in it are separated from everything else in the milk—the only substances removed in the cream are fat, vitamin A, and vitamin D; the valuable lime and the protein, vitamin B, phosphorus, and iodine are all left in the "skim" or separated milk. Thus separated milk is almost as valuable in human diet as whole milk, especially as it is fairly easy to obtain supplies of vitamin A elsewhere—from green and yellow vegetables, cheese, eggs, and liver, for instance. Sunlight supplies vitamin D, and even with butter rationing New Zealanders get

SERVING 1¾ PINTS A DAY . . .

plenty of fat. In the country it is particularly easy and cheap to obtain supplies of separated milk, and even in the towns dried skim-milk is available at an approximate cost of 10d. a gallon or 1½d. a pint. Dried skim-milk still contains the lime, the phosphorus, and the protein, and if properly dried in a vacuum the vitamin B also, so that by keeping milk consumption high and milk bills low by the use of a large proportion of separated milk, the essentials to the diet contributed by full-cream milk are still maintained.

Bibliography: "Good Nutrition," Dr. E. Gregory, Department of Health Publication; "Cooking for Canteens," Miss C. McGibbon.

WAYS OF SERVING MILK

Interesting and appetising ways of serving milk so that it is not "just milk" and each member of a family gets 1¾ pints a day are as follows:—

Milk Drinks

Probably the easiest way of consuming fairly large amounts of milk at a time is to drink it. Half a pint at a time, that is 1¼ breakfastcups or about 2 teacups full, is easily taken as a drink at each meal or between meals, but unfortunately not all children, and even fewer adults, like milk just as it is. Most children, however, will take it readily enough if it is disguised in some form. There is a variety of patent food drinks on the market which may be made up with milk, but their use, while it makes a tasty drink, is rather expensive; their value lies chiefly in the fact that with them large quantities of milk are drunk. Cocoa is less expensive, especially if bought loose, but to get the best out of it the cocoa itself should be cooked, as it is starchy. In the recipes which follow there are simple ones for making cocoa and cocoa paste (ready cooked and sweetened cocoa) which keeps for weeks and needs only the addition of hot milk or hot water and milk before drinking.

Other simpler and cheaper ways of disguising milk are to add flavour, colour, sugar, caramel, etc., to whip it, to drink it through a straw, or from a coloured glass. Hot milk drinks especially are always more attractive if served in a glass.

Milk Puddings

As usually not all the day's requirements of milk will be taken as a drink, especially by small children, it is wise, beside serving it on porridge and on puddings, to learn to make varied and appetising milk puddings.

First on the list probably comes junket, which can be varied with colour, an egg, cocoa, coffee, or caramel. Variety can also be produced merely by serving in a different dish from usual.

Soft or baked custards and dishes of which custard forms the basis are probably next in popularity. A plain custard can be varied with colour, flavour, or caramel. A method of caramelising sugar is given in the recipes at the end of this article.

["*Dominion*" *photo.*

Groups of children receiving extra milk have shown as much as twice the increase in height and two and a half times the increase in weight of others not receiving extra milk.

White or coloured sauces make an attractive and interesting addition to many baked and steamed puddings. (There is a special section on white sauces in the recipes.)

Other simple types of milk pudding are a milk jelly and all its many variations. Some simple and some not quite so simple recipes are given. Many jellies completely disguise the fact that they are made basically of milk.

Cereals for milk puddings are not readily available again yet, semolina, cornflour, and macaroni being about the only three at present on the market, but when rice, sago, and tapioca return they, too, should not always be served plain. Some interesting cereal milk pudding recipes are included. Raisins and sultanas and other dried fruits, banana, apple, lemon, coconut, cocoa, coffee, and caramel can all turn plain rice or cornflour pudding into something deliciously new; porridge, too, is delicious made all or partly with milk.

Finally there are many puddings which use perhaps a pint of milk between six, and can rightly be called milk puddings, as they make a substantial contribution to the day's milk consumption. And when thinking of cost, it should be remembered that **all milk puddings can be made with skim-milk.**

Savoury Dishes Containing Milk

Milk drinks and milk puddings, however, by no means exhaust the ways of serving milk; there are many tasty, savoury dishes which use up considerable quantities of the 1¾ pints. Most common are those which utilise a white sauce—vegetables at dinner served with a white sauce, vegetables at tea served with cheese sauce, scalloped dishes, au gratin dishes, creamed dishes, souffles, and cream soups. If the sauce to be used with vegetables is made of skim-milk, the vegetables will supply the vitamin A, and the fat in the sauce will help to make up for the vitamin A and fat removed from the milk during separation.

It is as well always to use in the sauce some of the water in which the vegetables were cooked, as this contains valuable minerals and vitamin C.

Other savoury dishes frequently use quite a lot of milk. It may be added to soups or curries, mashed into potatoes or other vegetables, or added to minced left-over meat to moisten a shepherd's pie; fish may be baked in it, scrambled egg contains it, savoury custards need it, and batters are rich in it. Some of the many ways of using milk are suggested in the recipes at the end of this article.

MILK DRINK RECIPES

1. Cocoa—1 cup

1 level teaspoon cocoa
1 tablespoon boiling water
1 teaspoon sugar
Salt, 1 pinch
1 cup hot milk or ½ cup milk and ½ cup water

MILK DRINKS AND PUDDINGS

[*National Publicity Studios photo.*

Teachers report that children are showing greater activity and alertness since they have been receiving their half pint of milk daily at school.

Mix cocoa, salt, and sugar together. Add the boiling water and stir till smooth. Add gradually 1 cup hot milk or milk and water. Return to saucepan and cook over hot water for 20 minutes, stirring frequently. Whisk with an egg-beater to prevent a skin forming. Serve hot.

A few drops of vanilla may be added before beating, and a marshmallow or a teaspoonful of whipped cream (when available) may be floated on top just before serving.

Note: If the milk is first heated in the top of a double saucepan this may conveniently be used again when cooking the cocoa over the hot water.

Cocoa Paste

8 tablespoons cocoa
4 tablespoons sugar
1 cup boiling water

Mix cocoa and sugar, add the boiling water and cook 5 minutes, stirring well. Put into screwtop jars and use as required. Use 1 to 2 teaspoons cocoa paste to 1 cup hot milk according to taste.

2. Milk Shake

1 cup milk, warm or cold
1 teaspoon sugar (or honey or caramel)
¼ teaspoon essence of vanilla (or other essence)

Mix together and beat well. (A small quantity of egg white increases the frothing of the milk.)

3. Ginger Milk

¼ teaspoon ginger
1 teaspoon brown sugar
1 cup milk
1 teaspoon golden syrup
1 tablespoon hot water

Mix ginger and sugar. Add syrup and hot water to dissolve. Pour on hot milk and beat till frothy.

4. Egg Flip

1 cup milk
1 egg, well beaten
½ to 1 teaspoon sugar
¼ teaspoon flavouring

Warm milk, pour over beater egg and sugar, and stir till sugar is dissolved. Add flavouring. Serve warm or cool. This is made extra nutritious with the egg, and because it is practically raw it is very easily digested.

5. Spice or Cinnamon Milk

1 cup milk, warmed
½ to 1 teaspoon sugar or honey beaten in
¼ to ½ teaspoon spice or cinnamon

Milk may also be served:—

1. Hot, with honey; this is very soothing for colds and sore throats.

2. Hot, with golden syrup.

3. Coloured and flavoured, and perhaps slightly sweetened, warm or cold.

4. Warm or cold with caramelised sugar and ¼ teaspoon vanilla.

MILK PUDDINGS

1. Junkets

2 cups milk
¼ teaspoon vanilla
2 teaspoons sugar
½ teaspoon rennet or according to directions given by manufacturer

Warm milk not hotter than blood heat (pleasantly warm). Dissolve sugar in it. Put rennet and vanilla in bowl in which junket is to set. Pour warmed, sweetened milk on to it and leave to set. Do not stir, as at certain temperatures the junket may set at once.

Variations:

1. **Cocoa.** 1 teaspoon to 1 cup milk. **Pour 1** tablespoon boiling water on to cocoa and boil. Add milk to warm.

2. **Caramel.** Caramelise 1 tablespoon sugar. Dissolve in warm milk. **Add no other sugar but** use milk, rewarmed if necessary, when **all the** caramel has dissolved. Avoid over-caramelising, as acid will be produced.

3. **Chocolate.** ½oz. to 1 cup milk. Melt, add warm milk. Stir till dissolved. No extra sugar is needed if the chocolate used is sweet.

4. **Coffee.** 2 tablespoons coffee infusion or 1 teaspoon essence added to each cup of milk before warming.

5. **Egg.** Beat an egg and add to warming milk.

6. **Coloured.** The addition of food colouring to milk makes it attractive for little children.

Note: Milk used for junkets must be fresh. Rennet has no action on boiled or over-heated milk.

To Caramelise Sugar

Thoroughly clean a frying pan or shallow saucepan. Use one and a-half times the normal quantity of sugar, and warm it in a pan over low heat. Stir with a spatula or bendy knife, scraping sugar from the bottom of the pan as it melts. Continue warming till all the sugar is melted and the liquid is a golden brown colour. Do not let it get too dark or the flavour will be unpleasant. If it is not stirred the sugar on the bottom will melt and burn before the sugar on top begins to melt. The addition of a little vanilla to recipes using caramel greatly improves the flavour. Caramel takes some minutes to dissolve in **milk or** water, the time increasing in proportion to the quantity of caramel used. If milk is poured straight on to the hot caramel it will boil.

2. Custards

General Proportions

Soft or "boiled" custard—1 egg to 1 cup milk
Baked custard —1 egg to 1 cup milk
Moulded custard —1 egg to ½ cup milk

If eggs are scarce or expensive a **custard sauce** may be made in place of a custard.

1 egg
1 pint milk
1 tablespoon cornflour
1 tablespoon sugar
Flavouring

Mix the cornflour with a little of the cold milk. Heat the rest of the milk and when boiling pour on to cornflour mixture. Return to saucepan and stir till boiling. Add sugar. Pour on to beaten egg, and if necessary return to saucepan again and stir till it thickens. When slightly cool add flavouring.

A moulded custard is a small baked custard stiff enough to hold its shape when turned out. If the mould is lined with caramel before pouring in the uncooked custard mixture, and it is unmoulded while hot, the melted caramel will flow over the custard and make a very attractive dessert.

3. Custard Puddings

(a) Ice Cream Pudding

1 tablespoon flour
1 pint boiling milk
1 tablespoon sugar
2oz. butter
1 egg
Vanilla

MILK SAUCES AND SAVOURY DISHES . . .

Beat butter and sugar, add egg. Beat well, then add flour, and last boiling milk and essence. Stir well. Put into a piedish or glass casserole, standing in a dish of hot water (a meat-dish does very well). Cook till set like a baked custard.

(b) Maple Nut Pudding

3 cups milk
½ cup brown sugar
2oz. cornflour
¼ teaspoon salt
2 eggs (separated)
1 cup chopped nuts
½ teaspoon vanilla
1 tablespoon treacle

Heat milk and add to sugar, flour, and salt mixed to a paste with a little cold water. Cook 10 to 20 minutes. Add treacle and egg yolks, well beaten. Cook 1 to 2 minutes longer and cool. Add nuts and vanilla and fold in beaten whites. Serve warm or cold.

(c) Chocolate Pears

1½lb. cooking pears
1oz. cornflour (4 tablespoons)
3oz. chocolate or 2 tablespoons cocoa
1 pint milk
5oz. sugar
1 lemon
Vanilla

Peel pears thinly and cook whole with stalks on. Stand them upright in a glass dish. Make a sauce with the other ingredients and pour over the pears so that they are coated. Serve warm or cold.

4. Gelatine Milk Puddings

(a) Chocolate Jelly

2 dessertspoons gelatine (slightly heaped)
½ cup water
1 dessertspoon cocoa
1 pint milk
Vanilla
2 dessertspoons sugar

Mix dry ingredients with water in a small saucepan and stir till boiling. Cool slightly. Add to warm or cold milk. Add vanilla. Pour into wet mould or glass dish to set. Will set in an hour if cold milk is used.

(b) Mock Spanish Cream

1 packet jelly crystals
1 egg
1 pint milk

Mix and beat yolk of egg with a little milk. Add to the rest of the milk and heat till just boiling.

Just moisten jelly crystals with a little boiling water, pour custard over, and mix. Cool. Fold in stiffly-beaten egg whites. Pour into wet mould or glass dish.

(c) Chocolate Souffle

2 tablespoons gelatine
2 tablespoons cocoa
3oz. sugar
1oz. (2 tablespoons) butter
2 eggs
1 pint milk

Mix together all except eggs and cook over gentle heat till sugar and gelatine are dissolved. Add 2 egg yolks slightly beaten, cook till thickening. Cool. Fold in two egg whites stiffly beaten and flavour to taste. Pour into wetted mould.

(d) Honeycomb Pudding

2 eggs
½lb. sugar (1 cup)
Essence of lemon
½oz. gelatine (1 tablespoon)
3 cups mlik

Soak gelatine in 1 cup milk 1 hour; then add the rest of the milk, sugar, and gelatine to the beaten egg yolks. Heat, stirring till thick and nearly boiling. Add essence. Fold in stiffly-beaten whites. Pour into wet mould and set overnight.

5. Cereal Milk Puddings

(a) Java Cream

2 tablespoons sago
2 cups milk
pinch salt
1 egg
¼ cup sugar
½ cup coconut
Vanilla

Boil sago, milk, and salt 15 minutes till sago is clear. Mix beaten egg yolks and sugar and stir into sago. Cook until thickened. Remove from heat, add coconut, cool a little, and then fold in stiffly-beaten whites. Add vanilla. Serve cold.

(b) Sago Prune Dessert

2 tablespoons sago
⅛ teaspoon salt
2 cups milk
1 cup prune pulp
1 tablespoon butter
2 tablespoons sugar
2 eggs
4 tablespoons sugar

Wash sago and cook gently with salt and milk till clear, stirring well. Cool. Add butter, 2 tablespoons sugar, and beaten yolks and pour into greased dish. Bake ½ hour in a cool oven 300 degrees F. Spread with prune pulp and meringue made from egg white and 4 tablespoons sugar. Brown in a cool oven. Serve hot or cold.

Variations—1. Use apricot pulp.
2. Do not separate eggs and omit meringue.

(c) Tapioca Meringue Cream

(Can also be made with rice or sago.)

⅓ cup sugar
⅛ teaspoon salt
⅔ cup tapioca, rice, or sago
2 eggs (separated)
2 to 3 tablespoons jam or fruit pulp
4 cups scalded milk
1 teaspoon vanilla

Wash tapioca and stir in to hot milk in the top of a double saucepan. Boil for a few minutes, stirring well, then cook over boiling water till soft. Add sugar and salt and carefully stir in beaten egg yolks. Cook till yolks have thickened. Cool slightly, add vanilla, and pour into baking dish. Spread a thin layer of any jam or fruit pulp over the top and cover with meringue made from stiffly-beaten egg whites with 2 tablespoons sugar. Bake in moderate oven (350 degrees F.) 15 minutes till just browned.

Note: Chopped nuts, dried fruit, raw or cooked fresh fruit, or coconut may be folded into the cream with the vanilla.

(d) Chocolate Rice

¾ cup rice
3 cups milk
¼ cup sugar
1 tablespoon cocoa
Vanilla

Wash rice and stir into hot milk in the top of a double saucepan. Add cocoa and sugar mixed with a little cold milk. Cook over hot water till rice is soft (1 hour), stirring occasionally. Add vanilla. Serve hot or cold. An egg may be beaten in to the hot cooked rice.

6. Other Puddings Rich in Milk

(a) Trifle (Economical)

½ to 1 cup cake or flaked breakfast food crumbs
½ cup fruit pulp or jam
½ cup hot fruit juice (if available)
2 cups milk
essences
2 eggs
nuts or coconut if liked
1 tablespoon sugar

Crumble stale cake, buns, or breakfast food crumbs into a bowl. If no fruit juice is available put ¼ to ½ teaspoon each of as many essences as you have (not peppermint) into ½ cup hot water and pour over fruit. (Lemon, vanilla, almond, orange, rum, brandy, and raspberry essences are not too many.) Spread fruit pulp or jam (or both) over moistened crumbs. Make a soft custard with eggs, sugar, milk, and a little more essence and pour carefully over cake and fruit. If custard more than fills bowl serve the rest separately in a jug.

(b) Chocolate Raisin Pie

5 teaspoons cocoa
3 cups milk
½ cup sugar
2 eggs (separated)
3 heaped teaspoons cornflour
1 cup raisins
Vanilla

Line a greased plate or sandwich tin with short pastry and bake ¼ hour in a moderate oven. (Do not overcook pastry at this stage.)

Mix cocoa, milk, and sugar in a saucepan, and bring to boil. Pour into cornflour mixed to a thin cream with a little milk, return to saucepan and cook 5 minutes, stirring all the time. Remove from stove and add beaten yolks, raisins, and vanilla.

Pour into the baked pastry shell. Beat whites with 2 tablespoons sugar, spread over custard, and bake in a very slow oven till brown.

WHITE SAUCES

Proportions		Uses
1 tablespoon flour 1 tablespoon fat	1 cup milk	No. 1 white sauce: For cream soups and thin cheese sauce.
2 tablespoons flour 2 tablespoons fat	1 cup milk	No. 2 white sauce: For sweet sauce to serve with baked or steamed puddings, for gravies, creamed dishes, scalloped dishes, au gratin dishes, and vegetables in white sauce. When making gravy substitute all or part vegetable stock for milk.
3 tablespoons flour 3 tablespoons fat	1 cup milk	No. 3 white sauce: For souffles and croquettes and sauce fillings.
4 tablespoons flour 4 tablespoons fat	1 cup milk	No. 4 white sauce: For souffles that may not be able to be served at once.

Method: Melt fat, stir in flour slowly, and cook a few moments without burning. If savoury, add seasonings. If sweet, add sugar. Add milk slowly, stirring till smooth after each addition. Boil 3 minutes after all the milk is in.

To keep sauce hot place over hot water and cover with a well-fitting lid to prevent formation of a hard skin.

In making large quantities the milk may be heated separately and added hot.

In making gravy, brown the flour and fat before adding liquid.

Cheese Sauce for Au Gratin Dishes

Add ¼ to ½ cup grated cheese, 1 cup made white sauce. Stir till cheese is melted. Do not cook any more or cheese will go stringy.

Note: "Au gratin" means "with cheese."

Sauce for Vegetables or Vegetable Scalloped or Au Gratin Dishes

Use ½ milk and ½ vegetable water instead of all milk. Vegetable water will be salty, so taste before adding more salt.

DISHES USING WHITE SAUCE

1. Cream Soup

1 cup No. 1 white sauce
Seasoning
1 cup vegetable pulp (vegetable stock)

To prepare vegetable pulp rub cooked vegetables through a strainer with a wooden spoon. Any well-flavoured vegetable may be used, or a mixture of vegetables. A little onion improves most mild-flavoured vegetables like potato or marrow. Tomato makes a delicious soup.

Have both sauce and vegetable pulp hot and carefully add the pulp to the sauce, stirring well. Beware of curdling the soup at this stage, especially if the vegetable is acid. Combine only just before serving and avoid reheating or milk may curdle. Season to taste. Serve hot. Colouring or extra flavouring may be added.

Note: If a starchy vegetable is used, keep the vegetable stock back to thin the soup, as it should be of the consistency of thin cream when served. If necessary, thin further still with extra hot milk, other stock, or water. If a green vegetable is used, or tomatoes, use the stock in making the sauce, reducing the milk to half, as the soup will be thin enough when pulp and sauce are combined.

2. Scalloped Dishes

Alternate layers of cooked vegetables, fish, egg, meat, etc., and No. 2 white sauce with seasonings are put in a greased dish and usually topped with crumbs mixed with melted fat. This is then heated through and browned in the oven.

3. Au Gratin Dishes

Similar to scalloped dishes, but the sauce has cheese in it and grated cheese may be sprinkled on top.

4. Creamed Dishes

Any cooked food (usually savoury) is mixed with No. 2 white sauce and seasonings added. Serve hot on toast or with dry water biscuits, etc.

5. Souffles

1 cup No. 3 or No. 4 white sauce
3 eggs (separated)
Flavouring (sweet or savoury)
Seasoning or sugar

Make sauce and allow to cool. Separate eggs and beat whites stiffly with sugar or salt. Then beat yolks till thick and lemon coloured, and stir in to cool sauce. Stir this carefully into beaten whites. Turn into greased baking dish standing in hot water and bake 1 hour at a temperature not over 300 degrees F. (Bake ½ recipe ¾ hour.)

Use No. 4 sauce if there is any likelihood that souffle may have to stand before being served.

Sweet Souffles

Vanilla: Add 4 tablespoons sugar and 2 teaspoons vanilla.

Caramel: Caramelise 4 tablespoons sugar and dissolve in milk for sauce.

Fruit: Use part fruit juice in sauce, and add finely-chopped fruit to cooked sauce. Add sugar.

Savoury Souffles

Cheese: Add 1 cup grated cheese to sauce. Use salt and pepper.

Vegetable: Well-seasoned left-over cooked vegetables may be added to the sauce.

Savoury: Cooked fish, meat, raw celery, parsley, fried onion, etc., may be added to the sauce with seasonings.

SAVOURY MILK DISHES

[*Sparrow Industrial Pictures Ltd. photo.*

Considerable quantities of the daily 1¾ pints of milk can be used in many tasty, savoury vegetable dishes using a white sauce, and it is well to use in the sauce some of the water in which the vegetables are cooked, as this contains valuable minerals and vitamin C.

SAVOURY MILK DISHES

1. Cottage Cheese

1 pint yesterday's milk
2 teaspoons lemon juice or ½ teaspoon rennet

Mix together and stir over slow heat till curd and whey separate. Pour contents gently into muslin spread over basin. Tie corners and drain. Then beat drained curds with a fork and add a little cream or a spoonful of milk powder to enrich the flavour. Other savoury flavourings such as tomato sauce, parsley, vegetable extract, chives, etc., may be added.

Use as a savoury filling or spread, or in salads. (A pint of milk makes ½ cup.)

Use up the whey as a substitute for water in any gelatine recipe where the main liquid is water and the slightly-acid flavour of the whey would not matter.

2. Eggs Au Gratin

3 hard-boiled eggs
2oz. butter or fat
2oz. grated cheese
2 tablespoons breadcrumbs
1oz. flour
1¾ cups milk
¼ teaspoon salt
⅛ teaspoon cayenne

Make white sauce with fat, flour, and milk. Add seasoning and half the cheese. Slice eggs and spread in the bottom of a dish. Cover with the sauce. Sprinkle with crumbs and the rest of the cheese. Dot with fat if liked. Bake till the top is brown and the dish is hot through.

3. Vegetable Custard

2 cups milk
Left-over vegetables
Salt
4oz. carrot
4oz. parsnips
2 eggs

Beat eggs and pour heated milk over. Chop or dice cooked vegetables, add custard, and bake in a dish standing in hot water till just firm.

4. Tasty Fish Pie

Mashed potatoes
1 to 2 cups No. 2 white sauce
Seasoning
Cooked flaked fish
Tomatoes or tomato pulp if possible

Spread a layer of potatoes mashed with milk, dripping, and seasoning in the bottom of a greased dish, then put a layer of flaked cooked and boned fish mixed with tomato if available. Cover with white sauce and top with more potato or breadcrumbs mixed with melted dripping. Bake brown.

5. Fish Pancakes

4oz. flour
1 cup No. 3 white sauce
Tomato or Worcestershire sauce
½ pint milk
Pinch salt
2 eggs
Cooked flaked fish
Anchovy
Seasoning

Sift flour and salt. Stir in beaten eggs and milk till smooth. Let batter stand. Make 1 cup No. 3 white sauce and mix with flaked cooked fish, fresh or tinned, well-seasoned and flavoured with a tasty sauce.

Fry the batter in thin pancakes on a lightly-greased pan. Spread each pancake with hot fish filling, roll up, and serve hot with parsley and thin slices of lemon.

6. Savoury Patties

Chop 1 set of cooked brains finely with 1 hard-boiled egg, seasoning, and parsley. Add to 1 cup No. 2 white sauce and mix well. Fill baked pastry cases with mixture, or serve on toast. Heat through, garnish with parsley, and serve hot.

7. Creamed Vegetables

1 cup No. 2 white sauce
Cheese
2 cups left-over cooked vegetables
Seasoning

Mix sauce, vegetables, and seasoning. Heat through. Serve on toast. Sprinkle with grated cheese. If preferred, it may be just browned in the oven, garnished with parsley, and served hot.

8. Steamed Savoury

1 tablespoon breadcrumbs
1 beaten egg
1 tablespoon fat
1 tablespoon minced cooked onion
1 cup hot milk
1 cup minced cooked chicken, ham, fish, or left-over meat
1 dessertspoon chopped parsley
Seasoning

Mix all together. If using left-over meat, be sure mixture is sufficiently tasty. 1 teaspoon tomato or Worcestershire sauce would improve.

Turn into a greased bowl and steam for 20 minutes.

9. Tomato Toad-in-the-Hole

6 firm tomatoes
1 tablespoon chopped parsley
1 tablespoon melted fat
¼lb. flour
2 tablespoons breadcrumbs
1 pint milk
3 eggs
Salt and pepper

Sift flour and a little salt. Beat eggs, mix with milk, and stir into flour till smooth. Wash tomatoes and skin if preferred. Scoop a little pulp from the middle of each. Fill with stuffing made from the breadcrumbs, fat, parsley, salt, and pepper. Place in a greased baking dish. Pour batter over and bake in a moderate oven ¾ to 1 hour. Serve with bacon rolls if liked.

PLANNING THE KITCHEN IN UNITS

By NORMA K. METSON,
Rural Sociologist, Wellington.

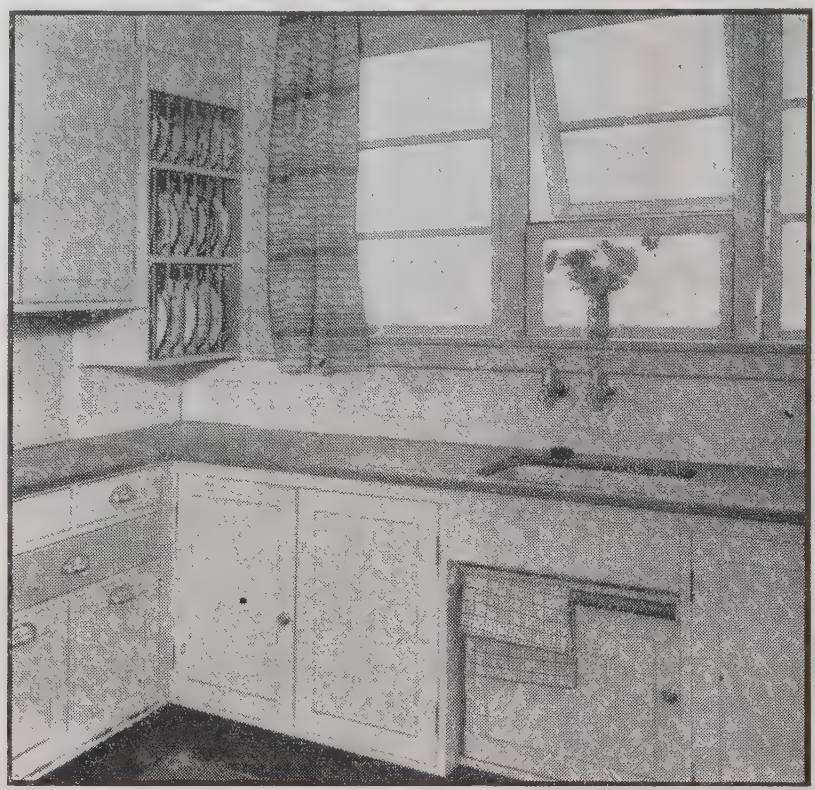
THE "unit" or package kitchen in which all essentials are provided in a very small space has been the subject of previous articles in this series. Unit furniture has also been mentioned—drawers, shelves, cupboards, tables designed so that each piece may be combined with others in several ways. The units now to be described are something different again. Briefly they are kitchen work centres, combining one of the main pieces of equipment with bench space and storage space. The sink unit or centre is discussed here, and later articles will deal with the range centre, the baking centre, and other less-important units.

THE appearance of some of the kitchens designed for new houses leaves the observer with the feeling that the dominating thought has been "uniformity at all costs." All cupboards are exactly the same size, all shelves exactly the same distance apart, all drawers exactly the same shape. Such regularity is certainly easier and cheaper to build, but it takes little account of the housewife's needs or of the varied articles which must be stored.

Made-to-measure Units

In the "made-to-measure" kitchen about which home-makers dream, storage space is planned around the main pieces of equipment and based on an inventory of the utensils and supplies kept in the kitchen. In other words there are several units functionally distinct but grouped together so that the natural routine of work follows the arrangement of the room. These units can be used in kitchens where continuous work surfaces are desired or they may be separated, as in an old kitchen where access to several doors must be preserved. The housewife who cannot start afresh but must make do with small alterations will find, too, that with this idea in mind she can make her kitchen much easier to work in.

Baking day in many homes means that armfuls of supplies are collected from many different sources and ranged on the kitchen table. Work is repeatedly interrupted to get the forgotten pastry brush or the particular spices required for a new recipe. Then, if for some reason lunch must be served a little earlier than was anticipated, everything must be cleared away so that the table can be set, even though the baking is not finished.



Planning the kitchen in units helps to eliminate such annoyances and saves many steps, because supplies and equipment needed for routine tasks are kept close to adequate working surfaces and things used together are stored together.

Functions of Sink Unit

The sink is at the end of practically all kitchen processes. The worker in a modern kitchen, however, should not need to spend as much time there as formerly, because the sink bench should no longer be the only work surface in the room. A location with a good light (both day and night) is important. If the window is not directly above the sink (the location generally preferred), it should be at the end of the bench so that the worker does not stand in her own light. A work surface at each side allows for stacking dishes before and after washing and eliminates the continual annoyance of the corner sink. One bench (the left hand) or both may be specially grooved or sloped toward the sink for more effective draining of washed dishes. The bench will normally be 21in. to 24in. wide, and a length of 30in. to 36in. at either side gives room for ample cupboards below and for a window and smaller cupboards above.

The chief use of the sink is, of course, dish washing, but even if the automatic dish-washer becomes universal and completely effective, sinks will still be necessary for the preparation of vegetables, fruit, and other foods which require washing and the provision of water for cooking and beverage making. Usually, too, the sink unit is the most convenient place for keeping the tins for food scraps and other refuse.

Articles to be Stored

The main articles to be stored in this area are those connected with the work described above.

1. Clean dishes and cutlery in everyday use. "Best" dishes are usually kept in a china cabinet or separate cupboard which may not be in the kitchen.
2. Dish pan and dish drainer if these are used.
3. Dishwashing supplies: soap, sandsoap, cleaning powder, dish mop, pot scraper, plate scraper.
4. Dishcloths, tea towels and hand towels, clean and in use.
5. Colander and strainers.
6. Vegetable and chopping knives, kitchen scissors, vegetable grater.
7. Chopping board.
8. Saucepans.
9. Cereals, dried fruits, and vegetables which require washing or soaking before use.
10. Containers for food and other scraps.

These items must be allotted to the available storage space above and below the sink bench. The upper left-hand cupboard is usually designed for china so that this can be put away immediately it is washed and dried. This cupboard should be planned with shelves close together so that plates may be kept side by side in low piles instead of stacked high, or it may have a vertically-partitioned rack. Two shallow drawers below the bench on this side will hold cutlery and clean tea towels. Use of the space below will vary. If it is the side of the sink nearest the stove, it is the appropriate place for the pot cupboard. Otherwise there may be a ventilated cupboard with slatted shelves for vegetable storage, shelves for the dish pan and colander, a vertically-divided compartment for trays and chopping boards, or a deep, divided drawer for the food supplies.

The upper right cupboard holds some of the less frequently used dishes or food supplies in jars and packages. Below the right-hand bench at least two drawers are needed, one for the vegetable knives, apple corer, and similar pieces of equipment, the other for kitchen towels. Use of the remaining space will be alternative with that on the left-hand side.

The space below the sink may be closed by a cupboard door if the housewife prefers invisible plumbing and uniform appearance, or left open, when it will provide a convenient home for the kitchen stool and a place to fasten two towel rails or a pull-out rack for the soap and cleaners. Another possible place for these is a narrow side cupboard opening toward the sink and built at the end of one of the upper cupboards. It should be ventilated and there should be one section large enough to take a full-sized bar of soap. The garbage tin, another difficult item, will be kept handy but out of sight if it is fastened to a bracket on the inside of a cupboard door.

Materials for Sinks and Benches

There are a few standard types of unit equipment available today, but most New Zealand kitchen fittings are constructed as the house is built. Sinks are usually enamel, occasionally stainless steel, the latter generally made with the bench top in one piece. If the sink is set into the bench it should always be made with a flat rim to fit over and not under the bench top.

Hardwood is the traditional material for bench tops, but it stains easily and is difficult to keep clean except by constant scrubbing. It is cheap and not hard on dishes. If surfaced with a durable enamel paint the wood is much easier to keep clean, but requires repainting at intervals.

Terrazzo, which is now commonly used, can be obtained in attractive colours. Bench top and splash-back are made all in one piece, and usually an enamel sink is set in. It is durable, except that the material does not resist the action of acids, and once pitting or chipping has occurred the surface may become seriously marred. Care is needed in handling dishes against the hard surface.

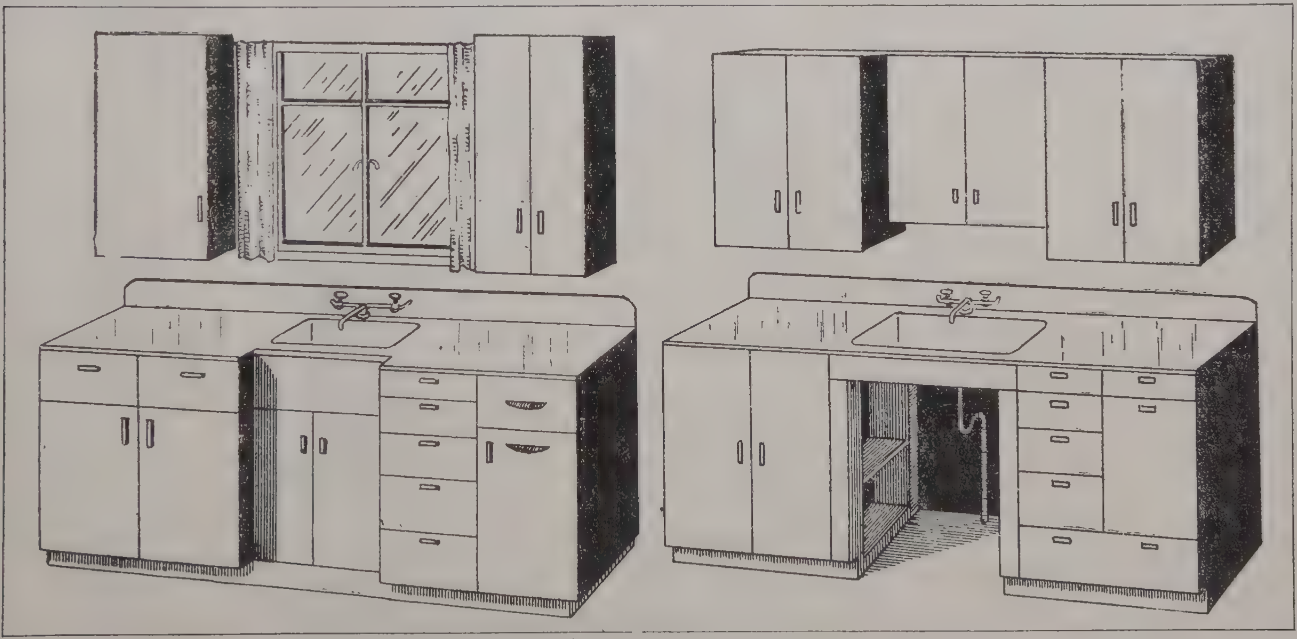
Stainless metal provides a sink, bench surface, and splash-back which is made in one piece without joins or seams. It is very easy to care for and provides a good working surface, but is unfortunately expensive and difficult to obtain.

Inlaid linoleum of good quality, though useful for table or other work surfaces, is not recommended for sink benches because of the difficulty of securing it and finishing the edges and its liability to rot and lift with water.

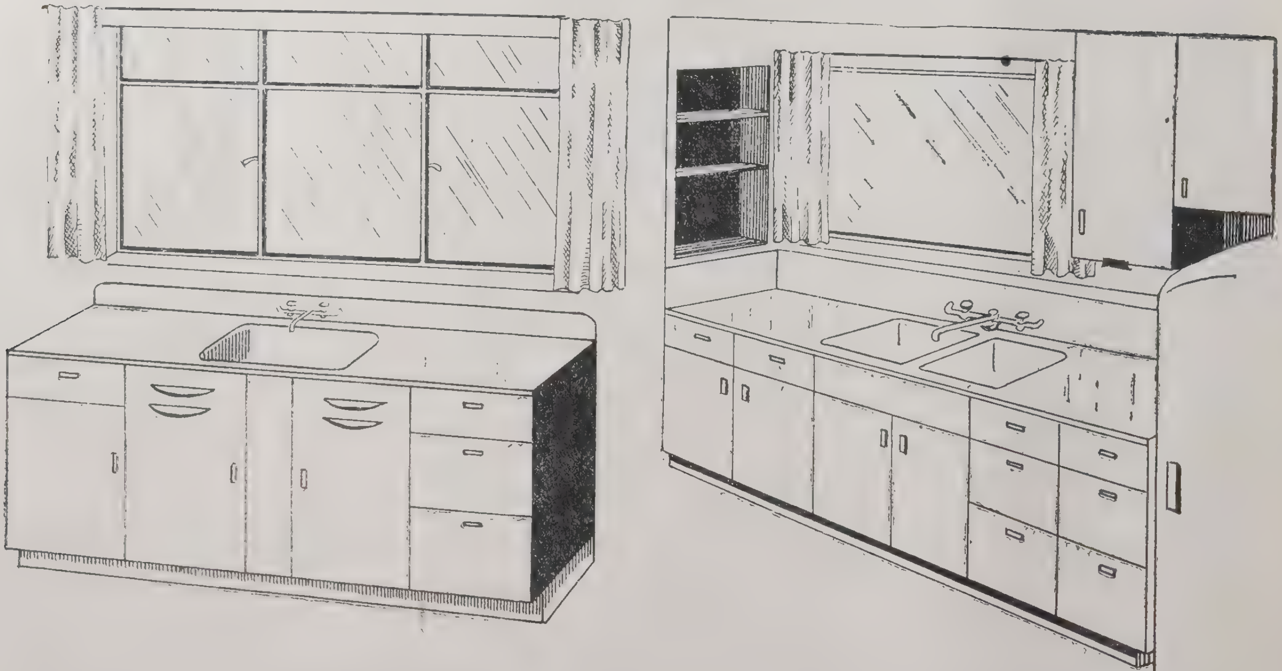
Newer types of materials not generally available such as special types of cement, plastic alone or as a surface for wood, and even specially-treated glass are being experimented with in an endeavour to improve on existing practices and evolve the ideal material which will be non-staining, waterproof, resistant to grease, acids, and alkalis, durable, practical for mass production, and reasonably cheap to manufacture and install. Glass in the form of glass bricks is a very desirable material to use round a kitchen window, especially if it is above the sink. Extra light is admitted and the sill and splash-back are easily cleaned. Taps of stainless metal are easily cleaned; a mixing tap allows water of any desired temperature to be run and can be made to swing so that it can be pushed back out of the way when dishes are being washed.

Dimensions for Sink Unit

The normal size for a household sink is 18in. x 12in. x 6½in., which is ade-



Left—Sink unit showing small cupboards above benches and a narrow window. Right—Sink unit with full cupboards 12in. in depth above benches, 6in. above sink. Sink left open with towel rack and shelves for soap and cleaners beneath.



Left—Sink unit with large window above sink and bench, and ventilated cupboards below bench. Right—Sink unit with double sink and recessed shelves at one end.

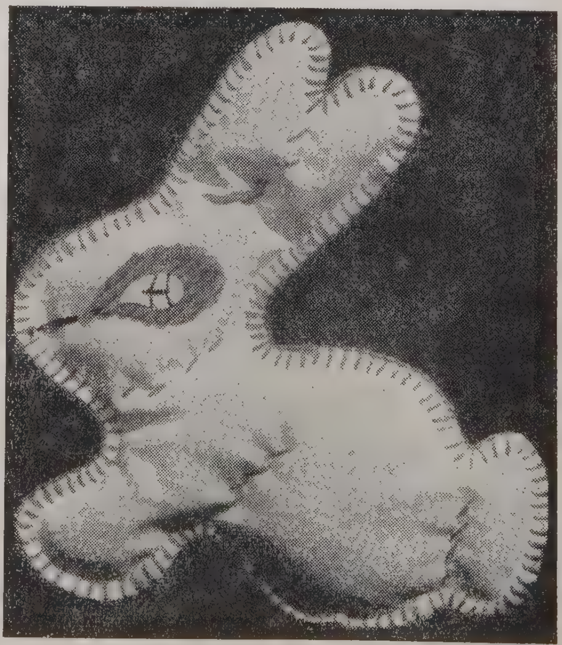
quate for ordinary dishes but may be too small if large equipment such as separator or churns must be washed in the kitchen. The next size is 22in. x 14in. x 6½in. The standard height for benches is 36in., and this, allowing for the depth of sink, gives a bottom level of 29 to 30in. This is a reasonably comfortable working height for smaller women but is low for some. If there are other working surfaces and the sink bench is used mainly for stacking dishes, a higher bench is desirable with the sink bottom 31in. to 32in. from the floor. If the sink bench is the main work surface, 36in. is the best all-purpose height. If cupboards are built right to the floor a recessed base at least 3in. high should be used to allow toe space. A good standard size for a sink bench is 21in. wide by 7ft. long. Cupboards above the bench should not be more than 12in. in depth and at least 12in. above the bench top. If the bench is to be used for more than dish washing and stacking, a distance of 16in. between the bench and the bottom of the cupboard is preferable. If cupboard shelves are made slightly narrower than the cupboard, racks, hooks, or narrow shelves can be put on the inner side of the door, making small articles easily accessible.

Choice of materials for kitchen units is restricted by expense and availability, but the two important features, comfortable working heights and correct arrangement of equipment within the unit, can be determined by the housewife who is remodelling or planning a new home.

An Easily-made Toy for Baby

The small bunny toy shown in the accompanying illustration is both easy to make and of a size suitable for a baby to hold. The materials needed are two small pieces of American cloth, felt, or plastic, wadding for stuffing, and coloured thread.

Using the illustration as a guide, draw the shape of the bunny on paper. Make the height from the top of the ears to the paws 7¼in. and the length from the mouth to the tail, 6½in. The measurement from the top of the ears to the neck is the same as that of the widest part of the body. Lay the material on the pattern and cut out two identical pieces. Cut two eye shapes 1¾in. long and two smaller eye shapes.



Sew the smaller pieces to the eyes and stick them in place. Place the wrong sides of the bunny together, blanket stitch round the edge, leaving 3in. open, insert the wadding, and continue stitching. Stitch the mouth and put in a few extra stitches on the body as shown.

Dead Flower Heads Mean Fewer Blooms in the Garden

FLOWER borders can be kept full of colour all the year round in the coastal and milder districts of New Zealand if attention is paid to a few simple principles. Frequent and regular removal of faded flowers is one of the most important of these rules, and this operation is considered in detail in this month's article, by J. P. Hudson, Horticulturist, Wellington.

PRACTICALLY all the gardening books on sale in New Zealand were written for gardeners overseas. That is one of many links with Britain, the Continent, and America, but it has had an unfortunate effect on the country's horticulture. In Northern Europe and in much of the United States gardens become very "dead" during the winter, when few flowers will bloom at all outdoors and fewer still will make a bold splash of colour until the earliest of the spring-flowering bulbs start to bloom.

In New Zealand borders can be kept colourful and bright and full of flowers through the year near the coast and in other mild districts, especially in the North Island, and only in inland areas with harsh, cold weather borders cannot be prevented from going dead in the winter time.

"Hardy" and "Tender" are Relative Terms

A big proportion of New Zealanders enjoy a climate where the ground never freezes and where frosts, when they occur, are quickly dissipated next morning by bright sunshine. The roots of many plants seem less resistant to frost than the leaves and branches. In Britain, where often the sun does not shine at all for days on end in the winter, frosts are not dissipated so quickly and in most years the soil becomes frozen to a depth of a few inches. Thus plants like geraniums and pelargoniums, that will stand some frost on the leaves but will die if their roots are frozen, are "hardy" (that is, will survive the winter outdoors) in most parts of New Zealand but are "tender" (will be killed in the winter) in all but the very mildest parts of Britain. The same applies to many other plants.

Thus a severe limitation has been set on winter gardening in Britain and the United States, reflected in overseas garden literature and, often, in the outlook of those who were brought up to British gardening practices, but there is much more scope for winter gardening in most parts of New Zealand.

Many Winter-blooming Flowers

By careful selection of plants it is possible for most home gardeners, on even small sections, to have between 20 and thirty different plants in flower throughout the winter in all the milder districts of the Dominion. More than half the population of New Zealand lives in the "mild districts," which for this purpose can be defined as those in which geraniums are hardy —can be wintered outdoors without dying.

To ensure that the borders are in flower all through the year certain simple rules should be observed:—

Feed the flower border.

Never miss an important sowing or planting date.

Give seedling plants ample room.

Do not let weeds compete with the flowers.

Where necessary, stake or support plants in ample time before they are blown over.

Pick off dead flower heads regularly.

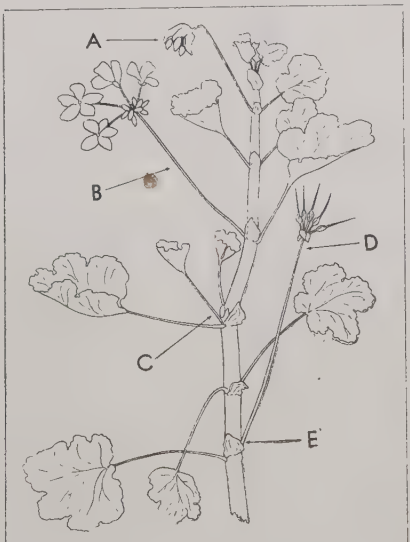
DEAD FLOWER HEADS . . .

Each of these rules is, perhaps, equally important, and each will be dealt with in detail in future articles, but the last is the one most often neglected or misunderstood and will be considered carefully this month.

Though pleasure or profit may be drawn from looking at or smelling or eating plants, they do not grow for the benefit of people but to fulfil their own natural functions in life. It happens that many flowers have symmetry, colour, or fragrance, and that enjoyment may be found in looking at them, but from the plant's point of view the flower is but one stage in the consummation of its urge to reproduce itself, to ripen seeds and scatter them, so ensuring the survival of the species.

Having seeded, many short-lived plants, like annuals and biennials, die outright. Perennials do not die, but often cease to flower and go about the business of preparing for the next season's blooms and recuperating from the exhausting process of ripening a crop of seeds and storing in each one a supply of concentrated food for the use of the young seedling.

If the plant can be frustrated by the removal of the flower before it has time to produce seeds, no energy is dissipated in the ripening of an unwanted seed crop, and very many plants will strive to repair their loss by producing more flowers for the pleasure and profit of the grower.



The system of flowering in a geranium plant. The youngest flower buds are found near the growing point (A), more growing in succession as the shoot extends. Flower (B) is fully open, and the lowest flower spike (D) has faded and should be snapped off at (E). A side shoot (C) will grow into a new flowering branch. (For the sake of clarity a rather drawn shoot has been illustrated. The leaves are usually produced more closely together than shown.)

Reasons for Picking Dead Heads

In considering this important operation, plants can be divided into three types: Those that bloom only once a year, those which do not produce seed, and all the others.

Many plants like daffodils and most other bulbous plants, rhododendrons and most other flowering shrubs, and chrysanthemums and many herbaceous perennials flower only once a year. Picking off the flowers from these as soon as the petals fade will not result in a second crop of bloom but will conserve the strength of the plants and, especially in the case of the bulbs, result in finer flowers being produced in the following season.

A few garden plants, especially those which are hybrids or have double flowers, are sterile and produce no seeds. Faded flowers are removed from these for the sake of tidiness rather than to encourage the plant to produce more.

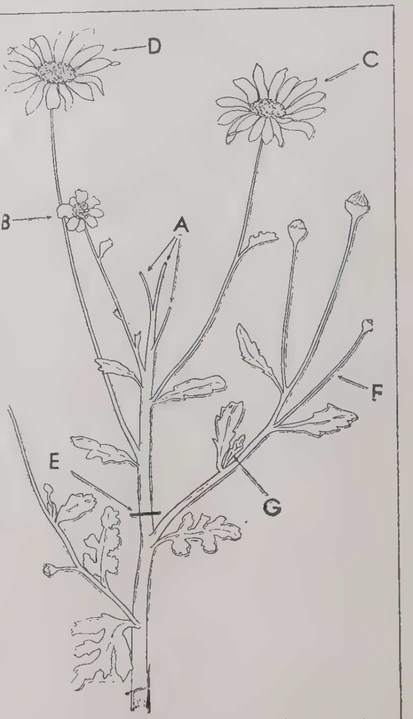
The third group of plants grown in the flower garden includes many perennials, like dahlias and geraniums, that produce a succession of blooms, and practically all the biennials and annuals. These are the plants that respond particularly well to having their faded flowers picked off regularly by blooming more freely and for far longer than if flowers are allowed to go to seed.

As with most tasks that are worth doing at all, this one is worth doing well. It is most important that plants should be looked over at least once a week and never left for longer. A flower on which the petals are just fading is easily seen and picked off, but heads from which the petals have actually fallen are not so readily found, especially if later flowers or leaves have grown up above and hidden them, and there is a danger of many being missed if the work is not done at least weekly. The work must not only be done regularly to be effective, but must also be done with understanding if the plants are to benefit to the full extent from removal of their spent flowers.

Flowers Produced in Three Ways

Within the third and most important group mentioned flowers are produced in three distinct ways, and for each there is a different method of removing dead flower heads:

Geranium Type: Each main shoot continues to grow indefinitely, producing flower spikes as it grows from the places where the leaves join the stem (axils). The youngest flowers are therefore always near the growing tip of the shoot and the older ones lower down the stem. Examples are geraniums, pelargoniums, and sweet peas (in all of which several flowers are borne on each main flower stalk), violas and pansies (in which each stalk



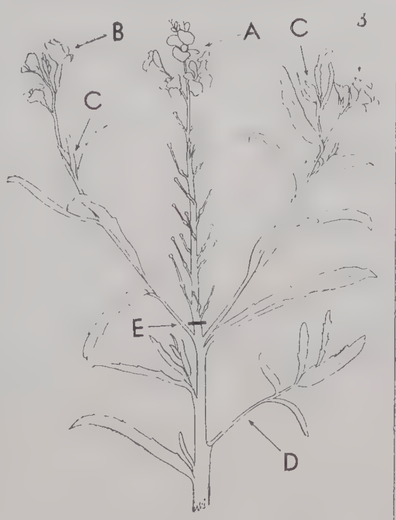
The marguerite, showing the way in which blooms are produced and should be removed to keep the bush in flower. A flower is produced at the extreme tip of each new branch followed by several other flowers produced in succession *down* the shoot, below the first. Below this again new branches are produced which in turn repeat the process. Three faded flowers have already been cut off (A), one is now ready for removal (B), and two are in full bloom. Flower (C) will fade next, and then flower (D). When (D) is removed the whole branch, which will then have finished flowering, should be cut off at (E), by which time flowers on the new branch (F) will be fully open. By the time the flowers have all faded and been cut from branch (F) the new shoot (G) will have become a flowering branch, to maintain the succession, and so on. For the sake of clarity the full complement of leaves has not been shown. Note that the faded flower (B) is below the level of the current flowers and can easily be overlooked when dead heads are being taken off unless search is made for it in the proper place.

bears only one flower, and Iceland poppies (in which the main stem is so short that the leaves form a rosette). The lowest flowers or flower spikes fade first and should be removed by breaking or cutting them off close to the main stem.

Marguerite type: Each main shoot ends in a flower, which is followed by other flowers produced at successively lower levels, while growth of the plant is continued by new shoots that arise from much lower down on the flowering shoot. These new shoots repeat the same sequence of flowering. Examples are marguerites and pot marigolds (calendulas). The uppermost flower fades first and should be removed, then successively lower ones until ultimately the last flower on a branch fades, when the branch should be cut right back to where the new shoot is growing. That helps to keep the bush compact and in free flower.

Wallflower type: Each main shoot ends in a spike of flowers, the lowest flower of which opens first, followed in succession by other flowers higher up the spike. Side branches and more spikes of flowers are produced from lower down the main stem. Examples are wallflower, hybrid wallflowers, antirrhinums, stocks, and sweet alyssum. As each spike continues to flower for some time, flowers will still be opening at its tip when the lowest flowers have faded and gone to seed. There is always a temptation to leave each spike for as long as flowers continue to open at the tip, but that is most exhausting to the plant and often prevents more flower spikes from being formed lower down the stem, apart from the fact that spikes bearing seed pods look unsightly. In dealing with plants of this type some sacrifice is called for. Each flowering spike should be cut right back to the next lower spike when the bottom two or three seed pods are beginning to swell—that is, when the part of the spike still in flower is from a third to a half as long as the part where flowers have faded and from which petals have fallen.

Nothing will do more to keep the borders bright with flowers than the constant and regular removal of faded blooms. A little study along the lines indicated will make this routine job much more interesting. The flower heads picked off should all be put on the compost heap, where they will help to make valuable manure to assist the following season's flowers and keep the soil in good condition, and there should be no trouble from seeds ripening in the compost and being spread back on to the garden if heads are picked off at the proper time—when the petals are first starting to fade.



A hybrid wallflower, showing the system of flowering. Each shoot ends in a spike of flowers, the lowest of which open first and the others in succession up the spikes with the youngest flowers at the top (A). When the length of flowering spike from which the petals have fallen is about twice as long as that still bearing flowers, cut the spike off at (E). The new shoots (B) will by that time be in full flower, followed in turn by shoots (C), and so on. From time to time when the bush gets straggly it can be cut back quite hard to a lower shoot at (D).

Garden Work for January

Compost now maturing is best used on the flower borders, leaving the winter-maturing heaps to be dug into the vegetable garden. Riddle compost through a ½ to 1in. sieve, put the material that will not go through on to another heap for further maturing, and scatter the riddled compost over the surface of the flower borders, working it down between the plants. Regular dressings of compost work wonders in making the borders fertile, and every home gardener should be able to make enough compost from his own resources to dress the whole of the vegetable garden and flower borders at least once a year.

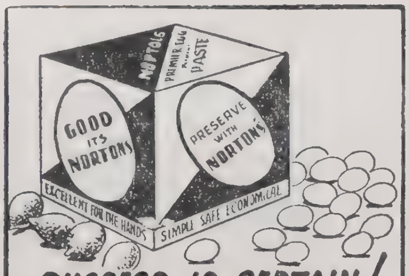
Cuttings of many shrubs and other garden plants can be taken now and rooted in a cold frame, or even in open soil in a shady place if they are covered for the first few days with an inverted glass jar or a box from which the top and bottom have been removed and a sheet of glass put over the top. The main point is to prevent all these leafy cuttings from flagging during the first few days by maintaining a moist atmosphere around them and shading them from the direct rays of the sun. Most of the plants propagated by home gardeners will root better and more quickly if first treated with one of the rooting hormones now on the market, used exactly according to the maker's directions. Among the plants which can now be propagated from cuttings are fuchsias (see "Journal" for May, 1947, for details and diagram), catmint, sweet Williams, pentstemons, marguerites, antirrhinums (a good way to increase favourite varieties true to colour), hybrid wallflowers, pinks, perpetual-flowering carnations, and many shrubs (including *Lonicera nitida,* lavender, buddleias, salvias, mock orange, *Azalea indica,* ornamental brooms, many variegated conifers, and hydrangeas (see January, 1947, issue for details). In taking cuttings of shrubs it is best to select short new side shoots and pull each off with a small "heel" of older wood. Trim the heel with a razor blade if it is ragged, shorten long shoots to 4 to 6in., and remove the two bottom leaves. The cuttings are then ready to be treated with rooting hormone, by the dipping of the lower end first in water and then into the hormone powder, and finally dibbled into the frame. Geranium and pelargonium cuttings will also root readily at this time of year.

Dahlias grown for large show blooms may now be fed by being watered with diluted animal manure or topdressed with complete flower border fertiliser (2oz. per square yard) well watered in, but it should not be necessary to feed plants grown for garden display if the soil was properly prepared before planting.

Freesias make excellent pot plants, bringing fragrance into the home in the winter. Pot eight or ten bulbs in a 4in. pot, using a good soil mixture such as the John Innes potting compost, then put the pots up to their rims in the soil in a cool part of the garden, cover them completely with an inch or two of old ashes, sand, or soil, and water them thoroughly. When shoots grow through this covering lift the pots carefully, remove the ashes, clean the pots, and take the freesias into the house to grow on and bloom in a sunny window.

Hydrangeas now in full flower will be encouraged to produce a long succession of blooms if given a generous application of liquid animal manure, diluted to the colour of weak tea, or a topdressing of complete flower border fertiliser (2oz. a square yard) thoroughly watered in.

Lawns should be given their quarterly dressing of fertiliser if the weather has not been too dry. The dressing should be postponed if the lawns are brown and grass has ceased to grow, as fertiliser applied to grass that is brown may prevent its proper



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Rural Housing

ARE you contemplating a new home on your farm or considering alterations to an old one?

Most women have valuable ideas on how convenience and comfort can be combined in the building of, or extensions to, a home. No one is in a better position to observe the shortcomings and to appreciate the sound points in construction than the woman who works and lives in the home. All the many ideas for improving country housing conditions are wanted by the Rural Development Division of the Department of Agriculture, which is carrying out a survey of rural housing, and from this information will prepare a schedule that will be sent to anyone interested. Results will also be summarised in the "Journal."

In addition, with the aid of the information secured from country women, the Department of Agriculture intends to prepare plans which will reflect New Zealand farm families' own preferences. They will, in fact, be plans of country homes designed by country people—people intimately associated with the routine of farm home life.

Play your part in this survey by writing to the Rural Sociologist in your district for a questionnaire. District offices are:—

North Auckland and Auckland: Rural Sociologist, Department of Agriculture, Auckland.

Taranaki, Wellington, Hawke's Bay, Gisborne, Nelson, and Marlborough: Rural Sociologist, Department of Agriculture, Wellington.

Canterbury and Westland: Rural Sociologist, Department of Agriculture, Christchurch.

Otago and Southland: Rural Sociologist, Department of Agriculture, Dunedin.

Left Alone is left in danger!

Parents have gone out for the afternoon and left Pat to his own devices. True, he was lying down quietly enough when they left, but now . . . Distinctly bored, he is wandering about. What makes the fire burn? What is that funny thing that Daddy scrapes his face with every morning? Electric switches, scissors, bottles of medicines—all sorts of things are full of interest and *full of peril* to a little child left alone.

YOU DARE NOT TAKE THIS RISK

Another dangerous practice is to leave a small child alone in a locked car. It is unkind, unfair, and could lead to tragedy. *Psychologically*, too, these practices are harmful. The sense of loneliness, the danger of frights, and the absence of affectionate reassurance when it may be needed can breed a life-long fear complex.

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Keep this announcement for future reference.

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recovery. The dressing consists of three parts of sulphate of ammonia, two parts of superphosphate (only one part on well-established lawns), and one part of sulphate of iron, applied evenly at the rate of 1oz. of the mixture to the square yard.

Meconopsis species, especially *M. betonicifolia* (*Baileyi*), the lovely blue poppy of the Himalayas, grow extremely well in shady places in the cooler parts of New Zealand and make a most attractive summer show if planted among shrubs or under trees and not allowed to suffer from drought. Seeds germinate best if sown immediately the seed pods are ripe—at this time of the year. They should be sown in pots or boxes and grown on in a shady place until ready for planting out in autumn.

Planting out must not be neglected if a long succession of bloom is to be maintained, though January is too hot and dry for the planting of many subjects. However, geraniums and pelargoniums rooted from cuttings taken earlier can now be planted out, gaillardias set out in the gaps from which Canterbury bells have been removed will flower next spring, and pot marigolds (calendulas) planted in any odd spaces, such as those which were occupied by spring-flowering bulbs, will make a glorious show of colour during the coming winter in all but the coldest districts.

Pot on young plants of *Primula malacoides*, primroses, balsams, choice polyanthus, cinerarias, and cyclamen to flower in the house during the coming winter. Most of these will produce highly-decorative plants in 5in. pots, suitable for growing on a windowsill.

Prick out biennials and other seeds sown earlier before the seedlings become overcrowded and drawn. Most of these are best planted out 2 to 3in. apart and allowed to grow into bushy plants before being set out in their flowering places. They can be grown on quite successfully in a small bed in the vegetable garden, but many gardeners prefer to prick out the slow-growing types into boxes from which they are later planted out. The tops should be pinched out of wallflowers when they are a few inches high to encourage them to bush out.

Prune shrubs which flower in early summer on shoots which grew last year, cutting out the branches that have flowered but leaving as many of the new shoots as possible, as they will bear next year's blooms. Shrubs pruned in that way, as soon as the flowers fade, include mock orange (philadelphus), diervillas (weigelas), flowering currant, forsythias, and early-flowering brooms.

Rambler roses such as Hiawatha and Dorothy Perkins, which finish flowering early in the new year, should by now have produced a number of very vigorous new shoots from the base of each plant. Cut branches which have flowered down to the ground and tie in the new shoots to take their places.

Rose blooms should always be cut with long stems, as that helps to prevent the bushes from becoming straggly and encourages strong new shoots to grow. For the same reason faded roses should be removed by cutting their stems back to the next flower bud or strong shoot and not by just breaking them off to leave a flowerless stalk.

Sow wallflowers (in the milder districts), annuals for autumn planting, and early-flowering sweet peas to produce winter blooms in very mild districts. At this time of year all flower seeds are best sown in boxes stood in a shady, cool place until the seed germinates, as it is easier to keep the soil uniformly moist in boxes than in the open ground.

Violas and pansies are now likely to have become straggling, overgrown, and exhausted by continuous flowering. Cut back alternate plants to within an inch or two of the ground and cut the remainder in a few weeks to encourage the clumps to send up new shoots. These can be left to produce a crop of autumn flowers or can be used later as cuttings, which root readily in a cold frame.

Watering may now be necessary. If so, give a really good soaking to one part of the border at a time rather than a light sprinkling over the whole area, as most of the water sprinkled on the surface will evaporate from the soil and do no good at all. Four gallons of water to the square yard, equal to an inch of rain, should penetrate to a depth of about 10in. and suffice for all the plants' needs for about two weeks. The ground should always be worked with a hoe an hour or two after a heavy watering to crack the surface and prevent the formation of a hard crust of soil.

Other Tasks for the Month

Christmas lilies can be moved best at this time of year, when they are more or less dormant.

Break off faded flowers from **gladioli** as the petals droop, and cut the spike off completely when all the flowers are over, but leave the leaves intact until they change colour. (See the September, 1947, issue for details.)

Clip **hedges** as they become ragged.

This is the best time of year to dig up, divide, and replant **pæonies** and **pyrethrums.**

Pot plants should be fed every two weeks (say on the first and fifteenth of each month) as described in the September, 1947, issue.

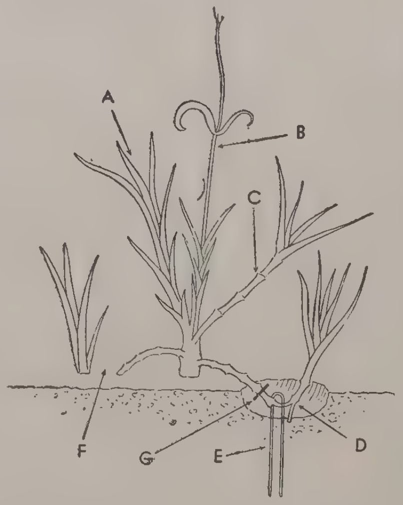
Many of the bedding plants will now be tall enough to need the support of bushy branches or thin stakes.

Reminders About Common Troubles

(1 tablespoon=1 fluid ounce.)

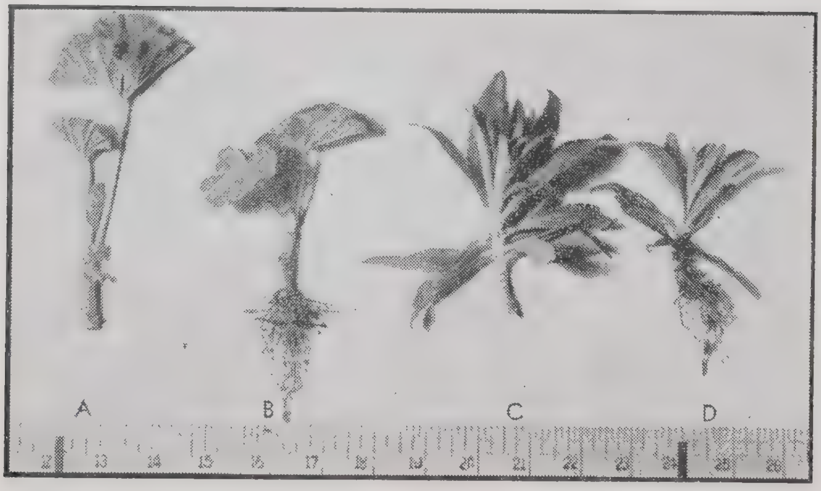
Caterpillars: Brown "woolly bears" commonly eat cineraria leaves, green

PROPAGATION OF BORDER CARNATIONS



Border carnations can be propagated by layering as they finish flowering. First weed around and under each plant, loosen the topsoil, and place a ½in. layer of sand (or seed-sowing compost if available) over the soil all round the plant to a distance of 8 or 9in., working it lightly into the loosened topsoil. Select a new shoot which has not flowered, remove the bottom few leaves, slit the stem through a joint with a sharp knife or razor blade, and continue the cut, about 1in. up the centre of the stem. With a wire hairpin peg the shoot into the soil, with the tongue open and the stem just below the surface of the soil. Water from time to time to keep the soil moist. The layer will root readily and can be severed at (G) in the autumn, and the young plant put out where it is to grow. It is better to spread sand widely round the plant, as suggested above, than to peg the layer into a mound of sand or soil, which is too liable to dry out.

The diagram shows a new shoot suitable for layering (A), and a shoot (B) which has flowered and is not suitable. The lower leaves are first stripped off (C), the tongue cut (D), pegged down with a wire hairpin (E), and covered over with soil (F).



Cuttings of geranium (A) and sweet William (C) prepared for insertion in a frame and as they will appear when rooted in autumn (B and D).

looper caterpillars feed on geraniums, pot marigolds, and many other plants, and leaf roller caterpillars are common on a variety of plants. All should be controlled at the first sign of damage by hand picking them, by spraying with a poisonous spray of lead arsenate (1¼oz. in 4 gallons of water), or by dusting with a derris or D.D.T. dust.

Geranium rust can be controlled by regular spraying with 2 fluid ounces of lime sulphur and ½ fluid ounce of colloidal sulphur in 2 gallons of water. (For full details see the August, 1947, issue.)

Greenflies can cause widespread damage to many plants and should be controlled by spraying when they are first seen with nicotine sulphate, 1 fluid ounce to 4 gallons of water, made more effective by adding 2oz. of soft soap or 6 fluid ounces of summer (white) oil emulsion. This spray should always be repeated two weeks later to kill young greenflies not affected by the first application. Derris dust also gives some control of greenflies.

Subterranean grass caterpillars (Porina) are the larvae of big, lumbering moths that fly at night through the summer and lay their eggs on the lawns. The caterpillars live in the soil but come to the top at night to feed, and they often ruin lawns by killing the grass and leaving large, bare, unsightly patches later in the season. They leave holes in the surface of the lawn, by which they can be distinguished from grass grubs, which do not come to the top. These caterpillars can be controlled by using a poisonous Paris green bait, made according to the maker's directions and scattered thinly over the surface of the grass.

Thrips feed by scratching the surface of many plants and eating the broken tissue. They leave the surface with a characteristic silvered, scurfy appearance. They can be controlled by using nicotine sulphate spray or D.D.T. dust, repeated two weeks later.

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D.D.T. as an Insecticide in the Home

THERE are sufficient supplies of D.D.T., made famous during the war as an insecticide, to enable the householder to wage war against insect pests within his own four walls, states an officer of the Health Department.

D.D.T. is what is known as a contact poison. In other words, when the insect walks over D.D.T. the substance is absorbed, probably through nerve endings, and has a powerful toxic effect on the nervous system, producing first convulsions, then paralysis, and then death. Death does not come rapidly, but takes from one to four hours, according to the type of insect. Mosquitoes, for example, quickly succumb, but cockroaches take longer to die.

D.D.T. has the advantage over other contact poisons that it is stable, is difficult to destroy, and exerts its effect for a prolonged period after being applied. It should, therefore, be applied in such a manner that the residual film of the substance will be left on the article or surface. As long as this lasts it usually spells death to the insect that touches it.

Suitable insecticides usually effectively control the visible insect population in a house, but those insects that escape go on breeding in nooks and crannies and continue to supply the nuisance in unabated quantities.

This is where the value of D.D.T. comes in. Its residual toxic effect is such that a room sprayed with D.D.T. solution will remain lethal to insects for weeks or even months. Experiments have shown that the results obtained by this are far in advance of anything experienced in the past.

When using D.D.T. for insect infestation, the practice is to use a fairly coarse spray of 5 per cent. solution in kerosene. The walls, the edges of the floor and ceiling, and the bedstead are sprayed.

Gloves and overalls should be worn while spraying and the hands thoroughly washed before eating a meal. If a fine spray is being used indoors, a gauze mask should be worn over the mouth and nose.

Care must be taken not to contaminate foodstuffs with D.D.T., for although it is relatively non-toxic to man, it can produce both gastric and nervous symptoms if inhaled or ingested in any quantity.

The first step in the control of flies should be to attack them at their breeding grounds. Frequent removal and proper disposal of manure, garbage, and other refuse are therefore of primary importance. Dusting and spraying of the breeding grounds with D.D.T. can take only second place, and reliance should not be placed on this line of defence alone.

Flies are very susceptible to D.D.T. Inside the house the best places to spray or smear the solution are on hanging light fixtures and drop cords, edges and arches of doors, window frames and sills, and other favourite haunts of the fly.

D.D.T. has no repellent effect against moths. To be effective the solution must come into contact with the moth larvae. Therefore all the fabric to be protected must be impregnated with the solution so as to have a residual coat of D.D.T. crystals.

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The New Zealand Journal of Agriculture

Volume 75, July-December, 1947

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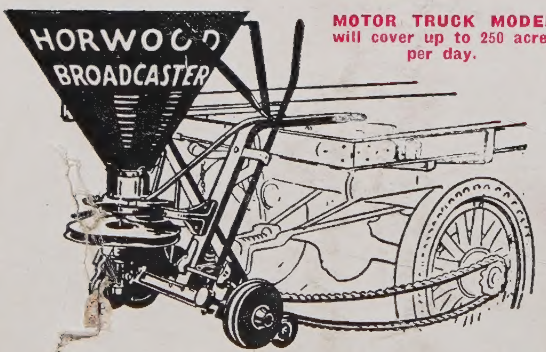

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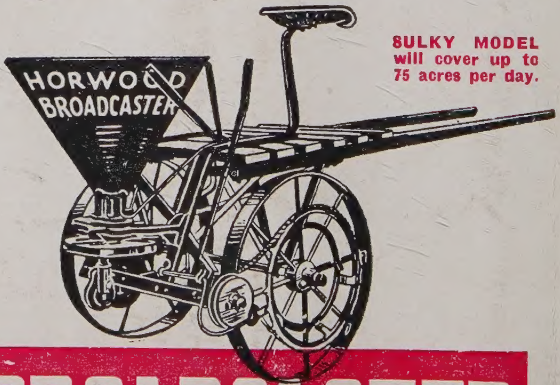

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